1990

MANITOBA INSECT

CONTROL GUIDE

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INTRODUCTION

This Guide serves as a quick reference to the 1990 chemical insect control recommendations for Manitoba.

Recommendations are based on those established by the Western Committee on Crop Pests and the Western Committee on Livestock Pests. The recommended insecticides have been selected for their effectiveness, availability, cost and safety. The number of insecticides recommended for the control of a specific insect have been kept to a minimum. Recommended insecticides are not the only ones which may be applied. Others may be used, provided that the label carries a recommendation for the intended use.

Both common and trade names of insecticides are used in the Guide. Consult the list of common and trade names on page 11. Before using an insecticide, always consult the container label for directions and precautions.

INSECT IDENTIFICATION

Over a million and a half insect species are known in the world. Nature keeps insects in balance with the surroundings. But, often, man's interference and manipulation of nature causes certain insects to become economic pests. Presently, insecticides are the most effective means of combatting insect infestations.

Due to the number of species of insects, correct identification requires special training. Since some insecticides kill specific insect pests, proper identification of the insect to be controlled is very important. Insect identification services can readily be obtained by sending specimens to:

Entomology Section
Manitoba Agriculture
911 Norquay Building
401 York Avenue
Winnipeg, Manitoba R3C 0P8

Carefully pack specimens to ensure they arrive in proper condition.

RELATED PUBLICATIONS

More information on insects and their control may be obtained from these publications available through the Distribution Centre, Manitoba Agriculture, 411 York Avenue, Winnipeg, Manitoba R3C 3M1.

Insect Control in the Home

Insect Control in the Home Garden

Insect Control on Fruit

Insect Control on Field Crops

Insect Control on Livestock

Insect Control on Ornamental Plants

Prevention and Control of Insects and Mites in Farm Stored Grain

Grasshopper Control in Manitoba

Field Sprayers

European Corn Borer in Manitoba

Insecticides for Dairy Farms

Slug Control in Gardens

Horn Fly on Cattle in Manitoba

TOXICITY OF INSECTICIDES

This table rates the toxicity of insecticides recommended in this Guide. Some are extremely toxic to handle and use. Others, although less toxic, can be hazardous if carelessly applied. **The lower the LD^{50} the more toxic the insecticide.** LD^{50} is defined as the amount of pure insecticide in mg/kg of body weight which will kill 50% of a test animal population.

ORAL LD_{50} RATINGS

INSECTICIDE **(common name)	*CLASS	LD_{50}	HAZARD	INSECTICIDE **(common name)	*CLASS	LD_{50}	HAZARD
aldicarb	C	1	⊛	lindane	OC	88	⊛
aluminum phosphide	F	1	⊛	malathion	OP	480-5800	⊛
azinphos-methyl	OP	16.4	⊛	methamidophos	OP	18.9	⊛
bendiocarb	C	34-64	⊛	metaldehyde	-	600-1000	◈
carbaryl	C	560	◈	methidathion	OP	25-54	⊛
carbofuran	C	10	⊛	methiocarb	C	135	⊛
chlorfenvinphos	OP	20	⊛	methomyl	C	17-26	⊛
chlorpyrifos	OP	163	⊛	methoxychlor	OC	5000-7000	▽
coumaphos	OP	90-100	⊛	mevinphos	OP	5-6.8	⊛
crotoxyphos	OP	125	⊛	naled	OP	430	⊛
cypermethrin	SP	4123	▽	nicotine	O	50-60	⊛
deltamethrin	SP	135	⊛	parathion	OP	13	⊛
diazinon	OP	300-850	⊛	permethrin	SP	4000	▽
dichlorvos	OP	80	⊛	phosmet	OP	230	⊛
dicofol	OC	809	◈	phorate	OP	1.6-3.7	⊛
dienochlor	OC	3160	▽	pirimicarb	C	147	⊛
dimethoate	OP	215	⊛	propoxur	C	100	⊛
dioxacarb	C	60-80	⊛	pyrethrum	O	584-900	◈
disulfoton	OP	12.5	⊛	resmethrin	SP	4240	▽
endosulfan	OC	110	⊛	rotenone	O	132-1500	▽
ethylene dibromide	F	146	⊛	sulfotep	OP	10	⊛
fenbutatin oxide	-	2631	▽	terbufos	OP	4.5	⊛
fensulfothion	OP	2.2	⊛	tetrachlorvinphos (75% WP)	OP	2420	▽
fenthion	OP	215	⊛	tetradifon	OC	14700	▽
fenvalerate	SP	451	⊛	trichlorfon	OP	560-630	◈
fonofos (10% Gran)	OP	212	⊛				

*Class of Insecticide:
OP - Organophosphate OC - Organochlorine O - Organic C - Carbamate SP - Synthetic Pyrethroid F - Fumigant

SOURCE: Guide to Chemicals Used in Crop Protection — Agrc. Can. Pub. #1093

**See page 11 for list of trade names.

PESTICIDE TOXICITY SYMBOLS

All pesticide container labels carry symbols indicating the degree of hazard and risk to the user.

The **categories of risk** are indicated by the following symbols:

Danger *Warning* *Caution*

Products that are the most toxic and pose the highest risk to the user carry the **DANGER** symbol. **WARNING** and **CAUTION** are less dangerous, respectively. Where the risk is minimal, no symbol is required on the container label.

The **categories of hazard** are represented by the following symbols:

Poison *Corrosive* *Flammable* *Explosive*

Categories of Risk symbols are used in conjunction with **Category of Hazard** symbols on product labels. For example, the following symbol would mean danger — poison.

Because all insecticides are poisons, the following explains the toxicity of the poison risk symbols and lists the type of safety equipment that should be worn by the user.

Poison Risk Symbols

Danger—Poison

***LD50** (see end of page for explanation)
- oral, less than 500 mg/kg
- dermal, less than 1000 mg/kg

Probable Lethal Dose for 68 kg (150 lb) person:
- 7 drops to 28 mL (1 oz) swallowed
- 7 drops to 85 mL (3 oz) absorbed

Safety Clothing To Be Worn:
Respirator, goggles, clean coveralls, water repellent hat, rubber gloves, rubber boots.

Warning—Poison

***LD50** (see below)
- oral, 500-1000 mg/kg
- dermal, 1000-2000 mg/kg

Probable Lethal Dose for 68 kg (150 lb) person:
- **28 to 85 mL (1 to 3 oz) swallowed**
- **85 to 200 mL (3 to 7 oz) absorbed**

Safety Clothing To Be Worn:
Goggles, clean coveralls, water repellent hat, rubber boots, rubber gloves.

Caution—Poison

***LD50** (see below)
- oral, 1000-2500 mg/kg
- dermal, 2000-5000 mg/kg

Probable Lethal Dose for 68 kg (150 lb) person:
- 85 to 227 mL (3 to 8 oz) swallowed
- 200 to 455 mL (7 to 16 oz) absorbed

Safety Equipment To Be Worn:
Clean coveralls, water repellent hat, rubber boots, rubber gloves.

***LD50** — a measure of toxicity that indicates the amount of pure pesticide that would produce a 50% mortality in a test animal population (rats, mice, guinea pigs). Source: Pesticides Division, Agriculture Canada.

INSECTICIDE DRIFT

All insecticides are subject to some drifting, whether applied from the air or by ground equipment. Insecticide drift can cause serious contamination. Users should apply insecticide formulations less prone to drift. Pay particular attention to wind velocity, using insecticides only when wind is at a minimum (less than 12 km/hr) (8 mph).

SEED TREATING

Usually more seed is treated than sown in any particular year. It is extremely important that seed treated with insecticide be used for seeding only.

It is illegal to mix treated seed with grain to be used for human consumption.

Left-over treated seed cannot be used as feed for livestock of any type.

Left over treated seed should be properly tagged and stored for seeding later.

AERIAL SPRAYING

Unless otherwise specified in the recommendations, apply at least 12 L of spray solution per hectare (1 gal/ac) to ensure adequate distribution of insecticide. Higher volumes provide better coverage and better control of insect pests.

Avoid spraying over houses, farm buildings and other occupied areas.

When applying synthetic pyrethroids leave a 100 meter buffer zone around water bodies in order to protect aquatic organisms.

Carry out aerial spraying only when wind velocity is below 12 km/hr (8 mph).

GROUND SPRAYING

Unless otherwise specified in the recommendations, 90 - 120 L water per ha (8-10 gal/ac) provides adequate insecticide distribution.

Ground spraying should take place when wind velocity is below 12 km/hr (8 mph).

INSECTICIDES AND POLLINATING INSECTS

The following points should be remembered when applying insecticides in the vicinity of pollinating insects.

- All insecticides are toxic to honeybees and other beneficial insects. Farmers, beekeepers, pesticide dealers and pesticide applicators must co-operate closely to minimize insect losses.
- Only the least toxic insecticides to bees should be used where honeybees or other pollinating insects may be foraging. Notify beekeepers in the area so they have an opportunity to protect their colonies.
- The application of insecticides during the early morning and late evening hours lessens the possibility of causing injury to honeybees and other pollinating insects.

Maximum times required for some of the commonly used insecticides to be reduced by weathering to a low hazard level to honeybees are shown in the table below.

FIELD APPLICATION HAZARD OF INSECTICIDES TO BEES[a]

Insecticide (common name)	Field Use[b] Honey bee	Leafcutter bee	Residue Hazard[c] (days)
aldicarb	H	H	none
azinphos-methyl	H	H	5
Bacillus thuringiensis	L	L	none
bendiocarb	H	—	-
carbaryl	H	H	3-7
carbofuran F	H	H	5
carbofuran G	L	L	none
chlorofenvinfos	L	—	-
chlorpyrifos	H	H	3.5
deltamethrin	H	H	1.5
demeton	M	M	1
diazinon	H	H	2
dichlorvos	H	H	-
dicofol	L	L	none
dimethoate	H	H	7
endosulfan	M	H	2
fensulfothion	H	—	-
fenthion	H	—	-
fenvalerate	H	H	-

FIELD APPLICATION HAZARD OF INSECTICIDES TO BEES[a] (cont.)

Insecticide (common name)	Field Use[b] Honey bee	Leafcutter bee	Residue Hazard[c] (days)
fonofos	M	—	-
lindane	H	—	-
malathion	M	H	2HB-6LCB
methamidophos	H	H	1
methidathion	H	H	7
methomyl	H	H	1.5
methoxychlor	M	M	.5
mevinphos	H	H	1.5
naled	M	M	1.5
oxydemeton-methyl	M	M	.5
permethrin	H	H	5
phosphamidon	H	H	5
pirimicarb	M	M	-
propoxur	H	H	-
pyrethrum	L	—	none
rotenone	L	—	none
tetradifon	L	M	.5
trichlorfon	M	M	.5

[a] Most of these chemicals have not been tested for bee toxicity under Western Canadian conditions; the data herein is for a general guideline only. Source: Atkins et al., Toxicity of Pesticides to Honey Bees, University of California, Co-op. Extension 170, 1974

[b] Field application where bees are, or will be foraging
High — Very poisonous to bees; do not apply to crops or weeds in bloom unless bees are kept off for the period that residue on the crop is a hazard.
Moderate — Moderately poisonous to bees; may be applied in the evening when bees are not foraging.
Low — Not very poisonous to bees; may be applied with minimum hazard to bees.

[c] Residue hazard; represents the average time in days that residue poisonous to bees will remain on the foliage. — indicates no data available.

HOW INSECTICIDES KILL

Insecticides enter an insect's body by contact on its outer shell or by ingestion, and kill by disruption of its nervous system.

Most insecticides, formulated for use as sprays, directly contact the insect on application or have residual contact for a time after application. Most major crop insect pests such as grasshoppers, armyworms, flea beetles and aphids are killed by direct or residual contact from spray applications of insecticides.

Some insecticides are formulated for specialized uses, killing specific insects in specific ways. Common examples are systemic pour-on insecticides for warble grub control in cattle, tree-trunk band applications for aphid control and granular or powder formulations for seed treatments for flea beetle control on canola. Other examples of specialized insecticides are scatter baits for farm fly control, fumigants for stored grain insect control and insecticide impregnated resin strips for indoor fly control. Insecticides, whether a direct spray or more specialized application have the end result of being absorbed through insects' outer shell or ingested by feeding causing death by disruption of the nerve processes.

COMPATIBILITY OF INSECTICIDES AND OTHER PESTICIDES

Insecticides may be mixed with other pesticides only when such mixtures are stated on the label. This practise, however, is generally not recommended for the following reasons:

1. Insect and weed problems seldom warrant control at the same time. Waiting to take control of both pests is likely to result in poor control of either or both.
2. Insect problems are specific and often on a limited crop area. Thus, using two pesticides together may result in high costs for unwarranted insecticide.
3. Delays after mixing, because of mechanical or other reasons, can result in loss of effectiveness.

WATER pH AND INSECTICIDE DEGRADATION

When certain insecticides are added to alkaline water (high pH), they begin to lose their effectiveness. The rate at which degradation proceeds depends on several factors. These include the pH of the water, the amount of insecticide being added and its effect on the pH of the finished spray, water temperature and the length of time the finished spray is allowed to stand.

In general, alkaline hydrolysis affects pesticides classified as organo-phosphates and carbamates. Some pyrethroids are also known to be similarly affected.

One thing to be aware of is that pesticide degradation (hydrolysis) in alkaline solutions is irreversible and initial effectiveness is lost.

The effect of alkalinity applies only while the mixture remains in the tank. The persistence of a pesticide is not affected by water pH after it is sprayed. It is very important therefore to spray the pesticide as soon as possible after mixing.

METHODS OF CALCULATING AMOUNT OF INSECTICIDE REQUIRED

Application accuracy is important. Uneven application or wrong dosage can be costly. Applying more than the recommended amount increases costs and may make crops unfit for sale or use because of a high residue. Less than the recommended amount may result in poor control, and poor control of the pest may result in heavy crop damage.

Recommendations for spraying livestock and buildings are often given as percent of finished spray or as kg of insecticide formulation per number of litres of water. It is often desirable to obtain the same strength spray using a different formulation or different amount of water. The following formulae may be used in making these calculations.

1. How to calculate the amount of emulsifiable concentrate needed to mix a spray containing a given percentage of active toxicant.

FORMULA:

$$\frac{\text{litres spray needed} \times \text{\% toxicant required}}{\text{kg of toxicant/litre of emulsifiable} \times 100}$$

EXAMPLE: - Metric

How much 50% malathion (500 g/L) is needed to make 50 L of 0.5% malathion?

$$\frac{50 \times 0.5}{0.5 \times 100} = \frac{25}{50} = 0.5 \text{ litres of 50\% malathion}$$

2. How to calculate the amount of wettable powder needed to mix a spray containing a given percentage of toxicant.

FORMULA:

$$\frac{\text{litres spray needed} \times \text{\% toxicant required}}{\text{\% toxicant used}}$$

EXAMPLE: - Metric

How many kg of 25% WP methoxychlor are needed to make 450 L of spray containing 0.5% toxicant.

$$\frac{450 \text{ L} \times 0.5}{25} = 9 \text{ kg}$$

3. How to figure percent active toxicant in a spray mixture.

FORMULA:

$$\frac{\text{kg used} \times \text{\% active ingredient in insecticide}}{\text{L spray mixture}}$$

EXAMPLE: - Metric

4.5 kg of 50% methoxychlor wettable powder were mixed in 225 L of water. What % active methoxychlor was in spray?

$$\frac{4.5 \text{ kg} \times 50}{225 \text{ L}} = 1\% \text{ active methoxychlor}$$

SPRAYER CALIBRATION

1. Measure off a known distance; the number of metres (feet) of travel to spray one hectare (acre) or a fraction thereof.
2. Fill your supply tank full of water.
3. Spray the measured distance as you would spray the field. Note speed of tractor and pressure of sprayer.
4. Carefully measure the number of litres (gallons) of water required to refill the tank. This is the volume sprayed.
5. Convert the volume sprayed to volume per hectare (acre) delivered by the sprayer at a given speed and pressure.
6. The volume per hectare (acre) delivered divided into the volume of the tank will give the number of hectares (acres) a tankfull of spray will cover. This is the hectare (acre) capacity of the tank at that pressure and speed and for the type of boom used.
7. Add the amount of insecticide recommended per hectare (acre), multiplied by hectare (acre) capacity of the tank, to the empty tank and refill with water.

If the field is sprayed at the same speed and sprayer pressure, the required amount of insecticide per hectare (acre) will be delivered. Changes in the pressure or speed will change the calibration of the sprayer. For more complete information refer to Manitoba Agriculture Bulletin "Field Sprayers" Agdex 744-1, 1982.

HOW TO CLEAN A CONTAMINATED SPRAYER

Sprayers contaminated with herbicides can be used for insecticides without danger to susceptible crops, provided the following cleaning procedures are carried out:

1. Fill and flush out the sprayer three times using clean water.
2. Fill the tank with a mixture of 1 litre warm water and 20 mL household ammonia (1 cup ammonia to 3 gallons of water). Allow this mixture to stand in the tank for 1 to 2 days and then run it through the machine. More rapid results can be obtained if household ammonia is used with steam.
3. Wash out the sprayer with soapy water and rinse again with clean water.

SAFETY IN HANDLING AND APPLYING PESTICIDES

Poisoning

The two types of poisoning are acute and chronic. Acute poisoning occurs from a single dose of pesticide. Chronic poisoning results from several small exposures over a period of time. Chronic poisoning may become acute if exposure is allowed to continue. It is more dangerous as symptoms can be confused with a cold or other common ailment. If symptoms such as headache, nausea or dizziness occur after exposure to an insecticide, see a doctor immediately, taking a container label with you. Some pesticides normally low in toxicity become much more toxic when used in combination with other pesticides.

Safety Rules

Insecticides may enter the body through the skin, the mouth and by breathing the vapors. These three pathways are to be considered when handling pesticides. The following precautions should be observed at all times but particular care must be taken when handling the concentrated pesticide during mixing operations.

1. Read the label on the container. This may save your life and prevent accidents. It will name the product and its most effective use. It will also explain how to handle the material and what should be done in the case of an accident.

2. When mixing spray solutions wear PVC hat, gloves and apron as well as chemical goggles, coveralls and NIOSH (National Institute of Occupational Safety and Health) approved dual cartridge agricultural respirator with pesticide cartridge.
3. When mixing seed treatments with seed, always wear goggles, respirator, gloves and arm protection such as a jacket.
4. Never mix spray solutions or treat seed inside a building. Do it outside so that the vapors can blow away.
5. Wear clean clothes each day when using pesticides.
6. Shower each day after using pesticides.
7. If insecticides are spilled on the skin, wash immediately and thoroughly with soap and water.
8. Change contaminated clothing as soon as possible and wash before re-use.
9. While spraying or dusting, prolonged exposure should be avoided; sprays and dusts should not be inhaled, smoking (especially handrolled cigarettes) should be avoided and all exposed parts of the body should be washed immediately after.
10. If you are taking drugs at the same time you are using pesticides, notify your doctor, since exposure to pesticides may alter the effectiveness of a drug.
11. Exercise care and caution when using pesticides, you may save a life or prevent serious illness.
12. If symptoms such as nausea, headache, blurred vision, numbness in fingers occur when using pesticides, see a doctor immediately. Take the pesticide container label with you, it will aid the doctor in his treatment.
13. Take care not to contaminate feed or water for livestock. The rates of application on the labels should be followed, and the cautions with regard to the use of treated crops strictly observed.

CONTAMINATION OF WELLS, DUGOUTS AND OTHER WATER SOURCES

Use extreme care to avoid accidental spilling of any pesticide into wells, dugouts or other water sources used for human and livestock consumption. Observe the following precautions:

1. If possible, do not fill sprayers directly from wells, dugouts, etc. The use of portable water storage tanks will allow water to warm to air temperature for better mixing and eliminates the possibility of contamination of water supplies.
2. If a sprayer must be filled directly from a well, dugout or similar source, the sprayer intake hose should be removed from the water source before the sprayer pump is stopped. This will prevent backsiphoning of chemical from the sprayer to the water source.

RESPIRATORS AND THEIR CARE

Recommended respirators are the dual cartridge agriculture type that have NIOSH approval. The proper cartridge to use will vary depending on the make. When purchasing a respirator ensure that the proper cartridge is obtained by specifying that it is to be used with pesticides.

To be completely reliable, respirators must be properly looked after. The following procedures are recommended:

1. Filters should be changed twice a day or more often if breathing becomes difficult.
2. Cartridges should be changed after eight hours of use or more often if any pesticide is detected.
3. Filters and cartridges should be removed and the face piece should be washed with soap and water after use. Rinse to remove traces of soap. Face piece should be dried with a clean uncontaminated cloth and then placed in a well ventilated area to dry.
4. When not in use respirators, filters and cartridges should be placed inside an airtight plastic bag and stored in a clean, dry place.

STORAGE OF INSECTICIDES

Store insecticides in a special area which is not normally used by anyone. This area should be locked and labelled.

Store insecticides in their original containers with label intact. Avoid causing dents or scratches which will weaken containers and may result in leaks. Dispose of leaking containers.

The following minimum storage temperatures are provided as guidelines for winter storage for liquid insecticides.

INSECTICIDES	MINIMUM STORAGE TEMPERATURE
Permethrin	−7°C
dimethoate	+5°C
diazinon	−18°C
malathion	−18°C
fensulfothion	−18°C
trichlorfon	0°C

INSECTICIDES	MINIMUM STORAGE TEMPERATURE
Carbofuran	0°C
Azinphos-methyl	0°C
methamidophos	-9°C
chlorfenvinphos	do not freeze
fenvalerate	do not freeze
methidathion	do not freeze
Cypermethrin (Ripcord)	do not freeze
Lorsban	may be frozen (agitate well before use)
deltamethrin	do not freeze
endosulfan	do not freeze
carbaryl	may be frozen (agitate well before use)
methomyl	do not freeze

DISPOSAL OF CONTAINERS AND SURPLUS SPRAY

1. Containers - paper or cardboard cartons may be burned on a hot fire composed of wood soaked in diesel fuel. The temperature generated by an ordinary fire is not sufficient to ensure decomposition. REMEMBER THAT SMOKE FROM PESTICIDE FIRES MAY BE TOXIC. DO NOT ALLOW SMOKE TO DRIFT OVER PEOPLE, LIVESTOCK OR BUILDINGS.
   - glass or metal containers must be decontaminated by rinsing thoroughly two or three times with a solution of equal parts chlorine bleach (ie. Javex) and water. The containers st ould then be broken or punctured and taken to the municipal dump for burial.
2. SURPLUS SPRAY MIXTURE - the best known method of disposing of surplus spray mixture is to spray it out in a specific area set aside for this purpose.
3. OLD OR UNWANTED INSECTICIDE - Contact the Manitoba Department of Agriculture, Entomology Section at 945-3857 in Winnipeg.

CLEANING UP SPILLS

Personal Protection and Cleanup Equipment

1. Broom
2. Shovel
3. Coveralls
4. Heavy rubber or P.V.C. gloves and boots
5. Respirators, dual cartridge agricultural type with pesticide cartridge
6. Hydrated lime - 2, 50 lb bags
7. Laundry bleach - 2 gallons of Javex or Chlorox
8. Caustic soda or lye
9. Heavy gauge plastic bags

When cleaning up any insectide, coveralls, rubber gloves and boots should be worn.

When cleaning up moderately to very toxic chemicals, wear a respirator as well. These chemicals include: carbofuran, azinphos-methyl, methomyl, lindane, chlorpyrifos, endosulfan and methamidophos.

If chemical is spilled on clothing, or comes in contact with skin, immediately remove clothing and wash skin with soap and water. The clothing should be washed before being worn again.

Liquid spills

1. Spread hydrated lime over spill in sufficient quantity to soak up liquid.
2. Allow it to sit until all liquid is soaked up.
3. Sweep up and place in heavy gauge plastic bag.
4. Soak entire area with laundry bleach (Javex or Chlorox) and spread more lime over the area.
5. Allow one or two hours for decomposition.
6. Sweep up and place in same heavy gauge plastic bags.
7. Remove sweepings to municipal dump for burial.

Dry powder

The procedure is the same as for liquid, except that the powder will have to be wetted before embarking on cleanup.

IN CASE OF PESTICIDE POISONING CONTACT:

POISON CONTROL CENTRE
Winnipeg Health Sciences
Children's Centre
685 Bannatyne Avenue
787-2591

WASHING CONTAMINATED CLOTHING

Pesticides can present a problem when spilled onto clothing. Residues on clothing can be absorbed through the skin to cause unwanted reactions. Special

laundering procedures are required to remove the chemicals from the clothing to prevent skin reactions or contamination of other clothing.

Clothes with chemicals on them must be handled with care. Neoprene gloves will prevent absorption as the highly contaminated clothing is handled for laundering. If clothes have been completely saturated with a chemical, discard.

Daily laundering may be necessary during times when chemicals are used on a daily basis.

Before washing, rinse clothing by presoaking in a suitable container, agitating in an automatic washer or spraying the garment outdoors with water. Wash only one or two garments at a time in lots of water. The clothes must be free for movement to work the chemical out of the clothing.

Use hot water (60 degrees C/140 degrees F) with the machine set at full water level and a normal wash cycle (about 12 minutes). Cold water temperatures are relatively ineffective in removing chemicals from clothing. Re-wash the clothes two or three times to be sure that all the chemicals are removed.

All laundry detergents are effective in removing chemicals from fabric, but heavy-duty liquid detergents are more effective in removing oil-based chemicals. Laundry additives such as bleach or ammonia will contribute to the removal of chemical residues, however, use only one at a time. Never mix bleach and ammonia.

Rinse the washing machine thoroughly after laundering contaminated clothing. Use hot water and the same detergent, machine settings and cycles used for laundering the contaminated clothing.

Line dry clothing to avoid contamination of the dryer. Sunshine will break down many chemicals.

Special attention to laundering chemical contaminated clothing will prevent unwanted skin irritations and contamination of other clothes.

CHOLINESTERASE TESTS

Organophosphate **insecticides** are cholinesterase inhibitors which, if inhaled or absorbed through the skin, can cause poisoning. A reduction in the amount of cholinesterase in the blood may indicate poisoning.

To guard against organophosphate poisoning, blood tests are taken to measure cholinesterase levels. Tests should be taken at the beginning and periodically throughout the spray season. Your physician will record your blood cholinesterase level and contact you if a change occurs. If a decrease in your level occurs, it indicates insecticide is entering your bloodstream. Remedial action to prevent further exposure must be taken immediately. For further information on arranging cholinesterase tests contact Entomology Section, Manitoba Agriculture, phone, 945-3860.

COMMON AND TRADE NAMES OF INSECTICIDES

(Trade Names Capitalized)

aldicarb - Temik
aluminum phosphide - Phostoxin,
- Gastoxin

Ambush - permethrin
Atroban-permethrin
azinphos-methyl - Guthion
Bacillus thuringiensis - Dipel
- Thuricide

Baygon - propoxur
Baytex - fenthion
Belmark - fenvalerate
bendiocarb - Ficam, Trumpet
borax
Birlane - chlorfenvinphos
carbaryl - Sevin
carbofuran - Furadan
Cattle Dust Bag - coumaphos
chlordecone
chlorfenvinphos - Birlane
chlorpyrifos - Dursban
- Lorsban

Ciodrin - crotoxyphos
Ciovap - crotoxyphos-dichlorvos
Co-Ral - coumaphos
coumaphos - Co-Ral, Cattle Dust Bag
Counter - terbufos
crotoxyphos - Ciodrin
crotoxyphos-dichlorvos - Ciovap
Cygon - dimethoate
Cymbush - cypermethrin
cypermethrin - Cymbush
- Ripcord
- Stockaid

Cythion - malathion
Dasanit - fensulfothion
DDVP - dichlorvos
Decis - deltamethrin
deltamethrin - Decis
diazinon
Dibrom - naled
dichlorvos - Vapona
dicofol - Kelthane
dienochlor - Pentac
dimethoate - Cygon, System, Lagon
Dipel — Bacillus thuringiensis
disulfoton - Di-Syston
Di-Syston - disulfoton
Disvap-tetrachlorvinphos
Dursban - chlorpyrifos
Dyfonate - fonofos
Dylox - trichlorfon
Ectiban - permethrin
endosulfan - Thiodan, Thionex
ethylene dibromide
ethylene dichloride
famphur - Warbex
fenbutatin-oxide - Vendex
fensulfothion - Dasanit
fenthion - Baytex
- Spotton
- Tiguvon
- Lysoff

fenvalerate - Belmark
Ficam - bendiocarb
flucythrinate - Guardian
fonofos - Dyfonate
Furadan - carbofuran
Gastoxin - aluminum phosphide
Guardian - flucythrinate
Guthion - azinphos-methyl
Imidan - phosmet
Ivermectin-Ivomec
Kelthane - dicofol
Lagon - dimethoate
Lannate - methomyl
lindane
Lorsban - chlorpyrifos
Lysoff - fenthion
malathion - Cythion
Mesurol - methiocarb
metaldehyde
methamidophos - Monitor
methidathion - Supracide
methomyl - Lannate
methoxychlor
mevinphos - Phosdrin
Monitor - methamidophos
naled - Dibrom
napthalene
Neguvon - trichlorfon
parathion
Pentac - dienochlor
permethrin - Ambush
- Atroban
- Ectiban
- Pounce
- Sanbar
- Sentinel
- Talcord

phorate - Thimet
Phosdrin - mevinphos
phosmet - Prolate
- Imidan

Phostoxin - aluminum phosphide
piperonyl butoxide
pirimicarb - Pirimor
Pirimor - pirimicarb
Prolate - phosmet
propoxur - Baygon
pyrethrum
resmethrin
rotenone
Ripcord - cypermethrin
Sanbar - permethrin
Sevin - carbaryl
Spotton - fenthion
Stockaid - cypermethrin
Supracide- methidathion
Tedion - tetradifon
Temik - aldicarb
terbufos - Counter
tetrachlorvinphos-Disvap
tetradifon - Tedion
Thimet - phorate
Thiodan - endosulfan
Thionex - endosulfan
Thuricide - Bacillus thuringiensis
Tiguvon - fenthion
trichlorfon - Dylox
- Neguvon

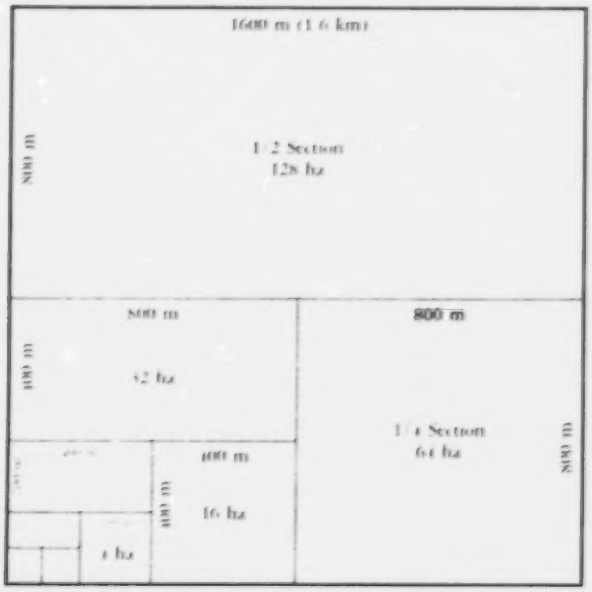
Trumpet - bendiocarb
Vapona - dichlorvos
Vendex - fenbutatin-oxide
Warbex-famphur

ABBREVIATIONS

L	- liquid	S	- sprayable powder
PO	- pour on	SP	- soluble powder
PCO	- pest control operator	EC	- emulsifiable concentrate
ULV	- ultra low volume	D	- dust
WP	- wettable powder	G	- granular
SC	- spray concentrate	LS	- liquid solution
E	- emulsifiable	C	- concentrate

ACRES TO HECTARES

Acres can be converted to hectares by dividing acres by 2.5.



METRIC CONVERSION FACTORS

Symbols

Length
mm - millimetre
cm - centimetre
m - metre
km - kilometre

Area
m^2 - square metre
ha - hectare

Weight
mg - milligram
g - gram
kg - kilogram
t - tonne

Volume
mL - millilitre
L - litre
m^3 - cubic litre

Pressure
kPa - kilopascal

Temperature
°C - degree Celsius

Relationships

Length
10 mm = 1 cm
100 cm = 1 m
1000 m = 1 km

Area
10 000 m^2 = 1 ha

Weight
1000 mg = 1 g
1000 g = 1 kg
1000 kg = 1 t

Volume
1000 mL = 1 L
1000 L = 1 m^3

Length
1 in = 2.54 cm
1 ft = 0.3048 m
1 yd = 0.914 m
1 mile = 1.609 km
1 m = 1.09 yd
1 m = 3.28 ft

Area
1 sq in = 6.452 cm^2
1 sq ft = 0.093 m^2
1 sq yd = 0.836 m^2
1 acre = 0.4047 ha
1 sq mile = 256 ha
1 ha = 2.47A (round to 2.5 in most cases)
1 m^2 = 10.8 ft^2
1 m^2 = 1.2 yd^2

Weight
1 oz = 28.35 g
1 lb = 0.4536 kg
1 ton = 0.907 t
1 kg = 2.20 lbs

Volume
1 fl oz = 28.41 mL
1 fl oz (US) = 29.57 mL
1 pint = 0.568 L
1 quart = 1.137 L
1 gal = 4.546 L
1 US gal = 3.785 L
1 cu in = 16.387 cm^3
1 cu ft = 0.028 m^3
1 cu yd = 0.765 m^3
1 L = 0.88 qt
1 L = 0.22 gal
1 m^3 = 35.71 ft^3
1 m^3 = 1.31 yd^3

Proportion
1 fl oz/acre = 70.21 mL/ha
1 oz/acre = 70.07 g/ha
1 lb per acre = 1.121 kg/ha
1 lb/in^2 (psi) = 6.895 kPa
1 pint/acre = 1.40 L/ha
1 qt/acre = 2.81 L/ha
1 gal/acre = 11.23 L/ha
1 kg/ha = 0.89 lb/A
1 L/ha = .089 gal/acre

Temperature
°C = 5/9 (°F - 32)
°F = 9/5°C + 32

LIVESTOCK INSECTS

NOTE: Horn fly resistance to synthetic pyrethroid ear tags has shown up in some cattle herds in Manitoba. In order to delay resistance, livestock producers should consider alternating use of ear tags with back-rubbers. Suspected horn fly resistance to ear tags should be reported to Entomology Section, Manitoba Agriculture.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial Measure	Minimum Days Application to Freshening	Remarks
DAIRY CATTLE					
Horn fly (apply insecticides when populations exceed 20 per animal)	Atroban	Apply 1 ear tag on flat surface of ear per animal.	Apply 1 ear tag on flat surface of ear per animal.	0	Remove tags before slaughter.
	Bovaid	Apply 1 ear tag on flat surface of ear per animal.	Apply 1 ear tag on flat surface of ear per animal.	0	Remove tags before slaughter.
	Cattle Dust Bag	Livestock self-duster. Use according to label directions.			Treat according to label directions.
	Ciovap	Apply as a coarse ready-to-use spray.	Apply as a coarse ready-to-use spray.	0	Spray should dampen hair on flanks, legs, brisket, head and neck.
	Co-Ral	Apply up to 60 g/animal of 1% dust into the hair on head, neck, shoulders and back.	Apply up to 2 oz/animal of 1% dust into the hair on head, neck, shoulders and back.	0	Do not repeat application within 10 days. Treat lactating dairy cows only after milking.
	Ectiban	Apply 1 ear tag tape/animal.	Apply 1 ear tag tape/animal.	0	
	Ectiban	Mix 1 L of 5% EC or 200 mL 25% EC/100 L water and apply 1-2 L/animal over entire body.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/25 gal water and apply 1-2 qt/animal over entire body.	30	
	Guardian	Apply 1 ear tag per animal.	Apply 1 ear tag per animal.	0	Do not apply on calves under 6 months of age.
	pyrethrin	Apply ready-to-use sprays daily to sides, back and underline.	Apply ready-to-use sprays daily to sides, back and underline.	0	Wash udder before milking.
	Sevin	Mix 1.2 L XLR in 100 L water or 1 kg 50% WP/100 L water and apply over entire body.	Mix 1 qt XLR in 21 gal water or 1 lb 50% WP/10 gal water and apply over entire body.	7	
	Stockaid	Apply 1 ear tag/animal.	Apply 1 ear tag/animal.	0	
Face fly	Atroban	Apply 2 ear tags/animal.	Apply 2 ear tags/animal.	0	
	Bovaid	Apply 1 ear tag on flat surface of each ear (two tags per animal).	Apply 1 ear tag on flat surface of each ear (two tags per animal).	0	Remove tags before slaughter.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial Measure	Minimum Days Application to Freshening	Remarks
	Clovap	Apply as a coarse ready-to-use spray to animal's face once or twice/day.	Apply as a coarse ready-to-use spray to animal's face once or twice/day.	0	
	Ectiban	Mix 1 L of 5% EC or 200 mL 25% EC/100 L water and apply 1-2 L/animal over entire body.	Mix 1 qt of 5% EC or 8 fl oz of 25% EC/25 gal water and apply 1-2 qt/animal over entire body.	30	For non-lactating dairy animals only.
	Guardian	Apply 2 ear tags per animal.	Apply 2 ear tags per animal.	0	Do not apply on calves under 6 months of age.
	Stockaid	Apply 2 ear tags per animal.	Apply 2 ear tags per animal.	0	
Mosquitoes	pyrethrin	Apply ready-to-use sprays daily to sides, back and underline.	Apply ready-to-use sprays daily to sides, back and underline.	0	Wash udder before milking.
	Vapona	Apply as a coarse ready-to-use spray to dampen hair.	Apply as a coarse ready-to-use spray to dampen hair.	0	
Black flies	Ectiban	Mix 1 L of 5% EC or 200 mL 25% EC/100 L water and apply 1-2 L/animal over entire body.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/25 gal water and apply 1-2 qt/animal over entire body.	30	For non-lactating dairy animals only.
	Cattle Dust Bag	Livestock self-duster. Use according to label directions.			Treat according to label directions.
Lice	Ciodrin	Apply 15-30 g of 3% dust/head for small and 30-60 g/head for large animals.	Apply 1-2 oz of 3% dust/head for small and 2-4 oz/head for large animals.	0	Repeat in 2-3 weeks if required.
	Co-Ral	Dust with 1% ready-to-use dust to all infested parts of body.	Dust with 1% ready-to-use dust to all infested parts of body.	0	
	Ectiban	Mix 1 L of 5% EC or 200 mL 25% EC/100 L water.	Mix 1 qt of 50% EC or 8 fl oz 25% EC/25 gal water.	30	
	Ivomec	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.		Follow label precautions and wait periods. For non-lactating dairy cattle only.
	rotenone	Apply 1% dust to point of visible cover.	Apply 1% dust to point of visible cover.	0	Rotenone is highly toxic to hogs. Hogs should not be in area of treatment.
	Sevin	Mix 1.2 L XLR in 100 L water or 1 kg 50% WP in 100 L water and apply as a spray over entire body.	Mix 1 qt XLR in 21 gal water or 1 lb 50% WP in 10 gal water and apply as a spray over entire animal.	7	

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial Measure	Minimum Days Application to Freshening	Remarks
Cattle grub (non-lactating dairy cattle)	Ivomec	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.		Follow label precautions and wait periods.
	Neguvon	Pour-on at the rate of 15 mL 8% Pour-on/45 kg body weight.	Pour-on at the rate of 1/2 fl oz 8% Pour-on/100 lb. body weight.	7	Do not apply in Dec., Jan. or Feb.
	Spotton	Apply with special applicator at 4 mL/136 kg body weight. Apply on one spot on the backline of the animal.	Apply with special applicator at 4 mL/300 lb body weight. Apply on one spot on the backline of the animal.	10	Do not apply in Dec., Jan. or Feb.
Cattle grub (lactating dairy cattle)	rotenone	Apply ready-to-use dust at intervals of 2-4 weeks.	Apply ready-to-use dust at intervals of 2-4 weeks.	0	Rub insecticide in the warble holes with a stiff brush before larvae drop.
Stable fly (apply insecticides when populations exceed 2 per leg).	Ciovap	Apply as a coarse ready-to-use spray.	Apply as a coarse ready-to-use spray.	0	Spray should dampen hair on flank, brisket, legs, head and neck.
BEEF CATTLE					
Horn fly (apply insecticides when populations exceed 40 per animal).	Atroban	Apply 1 ear tag on flat surface of ear per animal.	Apply 1 ear tag on flat surface of ear per animal.	0	Remove tags before slaughter.
	Bovaid	Apply 1 ear tag on flat surface of ear.	Apply 1 ear tag on flat surface of ear.	0	Remove tags before slaughter.
	Cattle Dust Bag	Livestock self-duster. Use according to label directions.			Treat according to label directions.
	Ciovap	Apply as a coarse ready-to-use spray. OR Use in backrubber device at the rate of 4.5 L ready-to-use mixture for each 6 m of cable.	Apply as a coarse ready-to-use spray. OR Use in backrubber device at the rate of 1 gal ready-to-use mixture for each 20 ft of cable.	0	Spray should dampen hair on flanks, legs, brisket, head and neck. Backrubber should be kept full at all times.
	Co-Ral	Apply up to 60 g of 1% dust/animal into the hair on head, neck shoulders and back.	Apply up to 2 oz of 1% dust/animal into the hair on head, neck, shoulders and back.	0	Do not repeat application within 10 days.
	Ectiban	Apply 1 ear tag tape per animal.	Apply 1 ear tag tape per animal.	0	
	Ectiban	Mix 1 L of 5% EC or 200 mL of 25% EC/400 L water and spray entire animal.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/100 gal water and spray entire animal.	7	
	Guardian	Apply 1 ear tag per animal.	Apply 1 ear tag per animal.	0	Do not apply on calves under 6 months of age.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial Measure	Minimum Days Application to Freshening	Remarks
Horn fly cont.	malathion	Use in backrubber at rate of 4 L 50% EC/96 L fuel, diesel or mineral oil.	Use in backrubber at rate of 1 gal 50% EC/22 gal fuel, diesel or mineral oil.		Do not treat animals under 1 month of age.
	methoxychlor	Apply as a high pressure spray at the rate of 0.5 kg 50% WP in 45 L water and 2.2 L mixture per animal.	Apply as a high pressure spray at a rate of 1 lb 50% WP in 10 gal water and 2 qt of mixture per animal.	7	Do not treat sick animals or animals under 1 month of age.
	Sevin	Mix 1.2 L XLR in 100 L water or 1 kg 50% WP/100 L water and apply as a spray over entire body.	Mix 1 qt XLR in 21 gal water or 1 lb 50% WP in 10 gal water and apply as a spray over entire body.	7	
	Stockaid	Apply 1 ear tag per animal.	Apply 1 ear tag per animal.	0	Remove tags before slaughter.
Stable fly (apply insecticides when populations exceed 2 per leg).	Ciovap	Apply as a coarse ready-to-use spray. OR Apply in a backrubber device.	Apply as a coarse ready-to-use spray. OR Apply in a backrubber device.	0	Spray should dampen hair on flank, brisket, legs, head and neck.
Face fly	Atroban	Apply 2 ear tags per animal.	Apply 2 ear tags per animal.	0	Remove tags before slaughter.
	Bovaid	Apply 1 ear tag on flat surface of each ear (2 tags per animal).	Apply 1 ear tag on flat surface of each ear (2 tags per animal).	0	Remove tags before slaughter.
	Ciovap	Apply as a coarse ready-to-use spray.	Apply as a coarse ready-to-use spray.	0	Spray should dampen hair on head, neck, brisket, legs and flank.
	Ectiban	Mix 1 L of 5% EC or 200 mL of 25% EC/400 L water and spray face and shoulders.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/100 gal water and spray face and shoulders.	7	
	Guardian	Apply 2 ear tags per animal.	Apply 2 ear tags per animal.	0	Do not apply on calves under 6 months of age.
	Stockaid	Apply 2 ear tags per animal.	Apply 2 ear tags per animal.	0	Remove tags before slaughter.
Mosquitoes	Vapona	Apply as a coarse ready-to-use spray.	Apply as a coarse ready-to-use spray.	0	Spray should dampen hair on flank, legs, brisket, head and neck.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Remarks
Black flies	Ectiban	Mix 1 L of 5% EC or 200 mL of 25% EC/400 L water and spray face and shoulders.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/100 gal water and spray face and shoulders.	7	
Horse flies	No satisfactory control method available. Darkened shelters may be provided for animals to escape fly pressure.				
Cattle grub	Ivomec	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.		Follow label precautions and wait periods.
	Neguvon	Pour-on at the rate of 15 mL 8% Pour-on per 45 kg body weight.	Pour-on at the rate of 1/2 fl oz 8% Pour-on per 100 lb body weight.	21	Do not apply in Dec., Jan. or Feb.
	Prolate	Dilute 1 part in 2 parts of water. Add the water to Prolate while stirring. Apply 28 mL of fresh mixture per 45 kg body weight. Pour the mixture along the spine of the animal.	Dilute 1 part in 2 parts of water. Add the water to Prolate while stirring. Apply 1 fl oz of fresh mixture per 100 lb body weight. Pour the mixture along the spine of the animal.	28	Do not use more than 225 mL (8 oz) of mixture on any animal.
	Spotton	Apply with special applicator at 4 mL per 136 kg body weight.	Apply Spotton with special applicator at 4 mL per 300 lb body weight.	45	Do not apply during Dec., Jan. or Feb. IMPORTANT: Apply on one spot on backline of animal.
	Cattle Dust Bag	Livestock self-duster. Use according to label directions.			Treat according to label directions.
Cattle lice	Co-Ral	Apply up to 60 g of 1% dust from a shaker can per animal.	Apply up to 2 oz of 1% dust from a shaker can per animal.	0	Do not repeat within 10 days.
	Ciodrin	Apply 15-30 g of 3% dust per animal for small animals and 30-60 g per animal for large animals.	Apply 1-2 oz of 3% dust per animal for small animals and 2-4 oz per animal for large animals.	0	Apply dust thoroughly to all parts of the animal.
	Ectiban	Mix 1 L of 5% EC or 200 mL of 25% EC/400 L water and spray entire animal.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/100 gal water and spray entire animal.	7	
	Ivomec	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.		Follow label precautions and wait periods.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Remarks
Cattle lice cont.	malathion	Apply as a high pressure spray at the rate of 1 L 50% malathion in 100 L water. Use 4.5 L of mixture per animal. OR	Apply as a high pressure spray at the rate of 16 fl oz 50% malathion in 10 gal water. Use 1 gal of mixture per animal. OR	0	
		Use in a backrubber device as a 2% ready-to-use solution.	Use in a backrubber device as a 2% ready-to-use solution.	0	
	Neguvon	Apply 15 mL of Pour-on per 45 kg body weight during the winter.	Apply 0.5 fl oz Pour-on per 100 lb body weight during the winter.	21	
	rotenone	Apply 1% dust thoroughly to all parts of animal.	Apply 1% dust thoroughly to all parts of animal.	0	
	Sevin	Mix 1.2 L XLR in 100 L water or 1 kg 50% WP in 100 L water and spray entire animal, or use up to 0.5 kg 5% dust per animal.	Mix 1 qt XLR in 21 gal water or 1 lb 50% WP in 10 gal water and spray entire animal or use up to 1 lb of 5% dust per animal.	7	
	Tiguvon	Mix 1 part 7.6% EC in 8 parts water and apply 62.5 mL/100 kg body weight along backline.	Mix 1 part 7.6% EC to 8 parts water and apply 1 fl oz/100 lb body weight along backline.	35	
American dog tick	lindane	Mix 400 g 25% WP, 500 mL 20% EC or 1 L 11% EC in 100 L water and apply up to 4.5 L of mixture/animal according to size.	Mix 6.5 oz 25% WP, 8 fl oz 20% EC or 16 fl oz 11% EC in 10 gal water and apply up to 1 gal of mixture per animal according to size.	30	One application usually sufficient for the tick season.
HOGS					
Mange mite	Ivomec	Apply 1% injectable drug by subcutaneous injection in the neck.	Apply 1% injectable drug by subcutaneous injection in the neck.		Follow label precautions and wait periods.
	lindane	Mix 20 g 25% WP, 25 mL 20% EC or 30-50 mL 10% EC in 10 L water. Apply 1.1-2.2 L per animal to point of wetting the skin.	Mix 3.2 oz 25% WP, 4 fl oz 20% EC or 7.2 fl oz 11% EC in 10 gal water. Apply 1-2 qt per animal to point of wetting the skin.	30	For Veterinary use only. Application may be repeated in 14 days if necessary.
	malathion	Mix 2 L 50% EC in 100 L water and apply 2.2 L per animal.	Mix 32 fl oz 50% EC in 10 gal water and apply 2 qt per animal.	0	Repeat application in 12 days if necessary.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Remarks
Lice	Co-Ral	Apply up to 30 g of 1% dust per animal to shoulders and back; 2 treatments 10 days apart in one season.	Apply up to 1 oz of 1% dust per animal to shoulders and back; 2 treatments 10 days apart in one season.	0	
	Ivomec	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.	Apply 1% injectable drug by subcutaneous injection in front of or behind shoulder.		Follow label precautions and wait periods.
	lindane	Mix 25 mL 20% EC or 50 mL 10% EC/10 L water and apply 1-2 L/animal.	Mix 5 fl oz 20% EC or 10 fl oz 10% EC/10 gal water and apply 1-2 qt/animal.	30	
	malathion	Mix 1 L 50% EC in 100 L water and apply 2.2 L of mixture per animal as a high pressure spray.	Mix 16 fl oz 50% EC in 10 gal water and apply 2 qt of mixture per animal as a high pressure spray.	0	Repeat application in 14-18 days if necessary.
	Tiguvon	Use a 3% ready-to-use pour-on and pour 30 mL/100 kg body weight along backline of each animal.	Use a 3% ready-to-use pour-on and pour 1/2 fl oz/100 lb body weight along backline of each animal.	14	
HORSES					
Face fly	Vapona	Mix 5 mL of 20% EC and 85 mL of corn syrup in 85 mL water. Apply 5 mL of mixture with a brush or spray to forehead of each animal.	Mix 1 tsp of 20% EC and 3 fl oz or corn syrup in 3 fl oz of water. Apply 1/5 fl oz of mixture with a brush or spray to forehead of each animal.	n/a	Apply during periods of high fly activity.
Horn fly	Vapona	Apply 28-56 mL ready-to-use per animal as a light spray once or twice daily.	Apply 1-2 fl oz ready-to-use per animal as a light spray once or twice daily.	n/a	Apply during periods of high fly activity.
Stable fly	Vapona	Apply 28-56 mL ready-to-use per animal as a light spray once or twice daily.	Apply 1-2 fl oz ready-to-use per animal as a light spray once or twice daily.	n/a	Apply during periods of high fly activity.
Lice	lindane	Mix 12.5 g 25% WP, 15 mL 20% EC or 30 mL 10% EC in 10 L water and apply 4.5 L of mixture per animal as a high pressure spray.	Mix 2 1/2 fl oz 25% WP, 2 1/2 fl oz 20% EC or 5 fl oz 10% EC in 10 gal water and apply 1 gal of mixture/animal as a high pressure spray.	n/a	Spray entire animal. Repeat application in 14-18 days if necessary.
	rotenone	Apply ready-to-use dust to infested areas.	Apply ready-to-use dust to infested areas.	n/a	

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Remarks
	Sevin	Apply ready-to-use 5% dust at 0.5 kg/animal.	Apply ready-to-use 5% dust at 1 lb/animal.	n/a	
Ticks	lindane	Same as for lice with exception of 1 application only.	Same as for lice with exception of 1 application only.	n/a	
SHEEP AND GOATS					
Ked	Co-Ral	Apply ready-to-use 1% dust to all infested parts of the body.	Apply ready-to-use 1% dust to all infested parts of the body.	0	
	lindane	Mix 12.5 g 25% WP, 15 mL 20% EC, or 30 mL 10% EC/10 L water and apply 1.1-2.2 L/animal once as a high pressure spray.	Mix 2 1/2 oz 25% WP, 2 1/2 fl oz 20% EC or 5 fl oz 10% EC/10 gal water and apply 1-2 qt/animal once as a high pressure spray.	30	
	rotenone	Apply 1% dust as required for control at shearing time.	Apply 1% dust as required for control at shearing time.	0	
Lice	lindane	Same as for Ked.	Same as for Ked.	30	
	rotenone	Apply 1% dust to point of visible cover twice, two weeks apart.	Apply 1% dust to point of visible cover twice, two weeks apart.	0	
Ticks	lindane	Same as for Ked.	Same as for Ked.		
POULTRY					
Lice	Ectiban	Mix 1 L of 5% EC in 100 L water and apply 4.5 L mixture per 100-150 birds as a low pressure spray.	Mix 1 qt of 5% EC or 8 fl oz 25% EC/25 gal water and apply 4 qt/100 birds.	7	
	malathion	Mix 1 L 50% EC in 100 L water and apply 4.5 L mixture per 100-150 birds as a low pressure spray.	Mix 8 fl oz 50% EC in 5 gal water and apply 1 gal mixture per 100-150 birds as a low pressure spray.	7	
	Sevin	Apply 450 g of 5% dust per 100 birds with a hand, rotary or puff duster. Repeat in 4 weeks if necessary. Use 1.1 kg of 5% dust per box for 50 birds in dust bath boxes. OR	Apply 1 lb of 5% dust per 100 birds with a hand, rotary or puff duster. Repeat in 4 weeks if necessary. Use 2.5 lb of 5% dust per box for 50 birds in dust bath boxes. OR	7	Do not contaminate nests, eggs or feed and water troughs.
		Mix 1.1 kg 50% WP in 113 L water or 1.2 L XLR/100 L water and apply 4.5 L mixture per 100 birds as a low pressure spray.	Mix 2.2 lb 50% WP in 25 gal water or 1 qt XLR/21 gal water and apply 1 gal mixture per 100 birds as a low pressure spray.		Repeat application in 4-8 weeks if necessary.

Host and Pest	Insecticide	MIXTURE AND METHOD OF TREATMENT Metric	Imperial	Minimum Days Application to Slaughter	Remarks
Mites	carbaryl	Same as for lice.	Same as for lice.	7	
	malathion	Same as for lice.	Same as for lice.	7	
Lesser meal worm	Sevin	Mix 1.25 kg 50% WP in 100 L water. Apply as a spray to floor area in broiler houses after each batch of birds.	Mix 2 1/2 lb 50% WP in 20 gal water. Apply as a spray to floor area in broiler houses after each batch of birds.	n/a	Do not contaminate feed or water troughs.
PETS					
Cat flea Dog flea	pyrethrin rotenone	Dust animals with pyrethrin or rotenone ready-to-use dusts thoroughly at weekly intervals or as necessary. Dust bedding and other infested areas.	Dust animals with pyrethrin or rotenone ready-to-use dusts thoroughly at weekly intervals or as necessary. Dust bedding and other infested areas.	n/a	

FARM BUILDINGS

Host and Pest	Insecticide	Metric	Imperial Measure	Remarks
GOOD SANITATION AND EARLY APPLICATION OF INSECTICIDES ARE THE KEYS TO AN EFFECTIVE FLY CONTROL PROGRAM.				
Housefly	FLY STRIPS			
	No Pest	Suspend 1 insect strip/30 m^3 air space.	Suspend 1 insect strip/ 1000 ft^3 of air space.	Replace after 3 months.
	SCATTER BAIT			
	Dylox	Scatter 1% bait using 125 g bait/100 m^2.	Scatter 1% bait using 1/4 lb/1000 sq ft.	
	Premium Golden Malrin	Scatter 125 g of 1% bait/50-100 m^2 to areas where flies congregate.	Scatter 1/4 lb of 1% bait/500-1000 sq ft to areas where flies congregate.	Do not apply where birds or animals have access to bait. Avoid direct contact with skin.
	Vapona Scatter Bait	Scatter 125 g of 0.25% bait/50-100 m^2 on floors, alleyways, doorways, window sills.	Scatter 1/4 lb of 0.25% bait/500-1000 ft^2 on floors, alleyways, doorways, window sills.	Do not use in milk rooms or milk processing rooms. Repeat application as required.
	RESIDUAL WALL SPRAYS			
	Cygon	Mix 2.5 L 4E/100 L water. Apply 5 L mixture/ 50-100 m^2.	Mix 20 fl oz 4E/5 gal water. Apply 1 gal mixture/500-1000 ft^2.	Remove livestock and poultry before spraying. Do not contaminate feed, litter or water.
	Diazinon	Mix 1.9 L of 50% EC in 100 L water and apply 5-10 L mixture/100 m^2 at 3-4 week intervals.	Mix 15 fl oz of 50% EC in 5 gal water and apply 1-2 gal mixture/1000 ft^2 at 3-4 week intervals.	Remove animals before spraying and keep them out at least 4 hours after spraying.
	Dylox	Mix 160 g 80% SP in 100 L water and apply 5 L mixture/50 m^2.	Mix 6 lb 4 oz 80% SP in 40 gal water and apply 1/2 gal mixture/500 ft^2.	Better residual control may be obtained by adding 100 g/L or 1 lb/gal of sugar water mixture.
	Ectiban, Sanbar, Sentinel	Mix 40-80 mL 25% EC or 100-200 mL 10% EC or 200-400 mL 5% EC/10 L water and apply to point of run off to areas where flies congregate.	Mix 0.6-1.25 fl oz 25% EC or 1.5-3.25 fl oz 10% EC or 3.25-6.5 fl oz 5% EC per gallon of water and apply to point of run off to areas where flies congregate.	Remove animals before spraying.
	SPACE SPRAYS			
	pyrethrin	Apply ready-to-use pyrethrin mixtures as a mist or space spray or from automatic dispensers.	Apply ready-to-use pyrethrin mixtures as a mist or space spray or from automatic dispensers.	Close doors and windows for about 10 minutes after application.

FEED LOTS

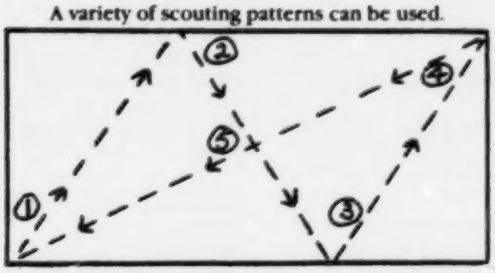
Host and Pest	Insecticide	Metric	Imperial Measure	Remarks
Housefly	Ectiban, Sanbar, Sentinel	Mix 40-80 mL 25% EC or 100-200 mL 10% EC or 200-400 mL 5% EC/10 L water and apply to areas where flies congregate.	Mix 0.6-1.25 fl oz 25% EC or 1.5-3.25 fl oz 10% EC or 3.25-6.5 fl oz 5% EC per gallon of water and apply to areas where flies congregate.	
	malathion	Apply 850-1000 mL malathion 50% EC/ha as a fog or aerosol.	Apply 12-14 fl oz malathion 50% EC/ac as a fog or aerosol.	
	pyrethrins	Apply ready-to-use mixture containing 0.25% pyrethrins as a thermal fog.	Apply ready-to-use mixture containing 0.25% pyrethrins as a thermal fog.	

CROP INSECTS

FIELD MONITORING FOR CROP INSECTS AND DAMAGE

Before any control measures are considered, thorough field scouting should be carried out to accurately assess the kind and number of insects present and the amount of damage being done.

A variety of scouting patterns can be used.



The scouting pattern shown, using 5 sampling sites, would provide at least a minimum of information on which to make a decision. Increasing the number of sampling sites will improve the accuracy of your monitoring.

The following table outlines monitoring methods and typical symptoms of damage for the most important economic crop pests in Manitoba.

Note: The economic thresholds listed in the recommendations are general guidelines only. Factors such as moisture conditions, temperature, stage of growth, etc., can increase or decrease the impact of insects on crop production.

Insect	Crop	When and How to Monitor	Typical Damage
Aphids	cereals	— July through early August — check 10 plants at each stop — record total no. of aphids and calculate average per plant	Visible wilting of plants, yellow patches in fields, plants are sticky.
	peas	— July when crop flowers — check 10, 20 cm (8") plant tips at each stop — record total no. of aphids and calculate average per plant tip	
Armyworms	cereals	— mid June through July — at each stop shake plants in 1m² (yd²) area and carefully check soil surface for dislodged larvae	Leaves stripped from plants, awns chewed from heads, heads clipped.
Bertha armyworms	canola	— late July through early August — at each stop, shake plants in 1m² (yd²) area and carefully check soil surface for dislodged larvae	Outer layers of stems and pods chewed resulting in whitish appearance, holes chewed in pods.
Cutworms	all	— late May through mid July — at each stop, check several 1m² (yd²) areas. Use trowel or shovel to carefully search through top 12-25 mm (1/2-1") soil for cutworm larvae	Plants cut off at or near soil surface, some leaf feeding above ground, plants missing from rows, bare patches appearing in fields.
	corn	— at each stop, examine 100 plants in a row — calculate % of plants cut off or showing leaf feeding	
	sunflowers	— at each stop, examine 100 plants in a row	
Diamondback moths	canola	— July through early August — examine 10 plants at each stop and calculate average per plant	Flowers clipped or chewed, outer layers of stem and pods chewed, holes chewed in pods.

Insect	Crop	When and How to Monitor	Typical Damage
European corn borers	corn	— July when corn is over 40 cm (16") in height — at each stop, examine 10 plants for egg masses and signs of shot-holing — calculate % of plants with shot-holes	Shot-holes in leaves, holes in stalk tassels and ears.
Flea beetles	canola	— May through June when crop is in seedling stage — examine 10 plants at random at each stop — estimate overall % leaf loss	Shot-holes in leaves, complete destruction of seedling plants late May through June. Holes chewed in pods in August (occasional).
Grasshoppers	all	— May through July — check along edges of crop particularly areas adjacent to hayland and pastures — estimate no. of hoppers/m^2 (yd^2)	Black strips along margins of newly emerging crops, head clipping later in season.
Plant bugs, lygus bugs	seed alfalfa	— June through mid August — make 5 sweeps with a 38 cm (15") insect net through alfalfa canopy at each sampling site — record total no. of plant and lygus bugs (both nymphs and adults) captured — calculate average no. per sweep	Clipping of flowers and small seed pods, flowers do not develop.
Sunflower beetles	sunflowers	**Adults** — May through early June on seedling plants — examine 10 plants at random at each stop	Leaves of seedling plants chewed or completely destroyed late May through June, shot-holes or large areas of leaves chewed July through August.
		Larvae — July through mid August — examine 10 plants at random at each sampling site — peel back leaves around growing tip and record total no. of larvae found — calculate average no. per plant	Leaves of plants chewed or completely destroyed.
Wheat midge	wheat	— July when crop emerges from boot stage until flowering is 50% complete — check crop canopy at dusk for signs of wheat midge adult activity — at each stop, examine 10 heads — record the no. of midge adults observed on or near heads — calculate average no. of midge per head	

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
CEREAL CROPS WHEAT, BARLEY OATS AND RYE						
Aphids	Barley prior to heading when aphid populations exceed 50/plant. All cereals after heading when populations exceed 50/head.	dimethoate 40	525 mL	215 ml	21	
		Malathion 500 EC	1.4 L	570 ml	7	
Armyworms	Spray when larval populations exceed 10/m² (yd²).	Dylox 420 Liquid	1.4 L	570 ml	21	
		Lannate L	1.25 L	505 ml	20	Do not use Lannate or Dylox on rye.
		Malathion 500 EC	2.8 L	1.1L	-7	
Cutworms	When cutworms exceed 3-4/m² (yd²).	Ambush 500 EC	140-300 mL	60-120 ml	1	For dry soil conditions use higher rate.
		Decis 5.0 EC	200 mL	80 ml	40	Do not apply Decis on rye.
		Lorsban 4 E	875 mL - 1.2 L	355-485 ml	60	
Grasshoppers	Spray when hopper populations exceed 7-12/m² (yd²).	Decis 5.0 EC	100-150 mL	40-60 mL	40	Do not apply Decis on rye.
		dimethoate 40	525 mL-1L	210-405 mL	21	Use higher rates for adult hoppers.
		Furadan 480 F	275 mL	110 mL	21	
		Lorsban 4 E	580-875 mL	235-355 mL	60	
		Sevin XLR PLUS	1.2-2.5 L	485 mL-1L	14	
Wheat midge	Spray when adult midge populations exceed 1/4-5 heads during period after 80% of heads have emerged from boot to end of flowering.	dimethoate 40	1.2 L	500 mL	21	
		Furadan 480 F	275 mL	110 mL	21	
		Lorsban 4 E	750 mL-1L	305-405 mL	60	
Wireworms	Apply to seed.	Use dual purpose seed treatment containing lindane.	As directed on container label.	As directed on container label.	n/a	Do not graze treated areas within 4 weeks of emergence. Wear butyl rubber gloves when treating seed.

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
CORN (field, forage)						
Armyworms	When armyworm populations exceed 10/m² (yd²).	Lannate L	1.25 L	505 mL	3	Apply as soon as larvae appear. Repeat as necessary at 3-5 day intervals.
Cutworms	Apply when 3% of plants are cut or 5% show leaf feeding.	Ambush 500 EC	140-300 mL	60-120 mL	1	For dry soil conditions use higher rate.
		Lorsban 4 E	875 mL - 1.2 L	355-485 mL	70	
European corn borer	Spray when 50% of plants show shot-holing in leaf whorls (early July) and repeat in 7 days.	Furadan 480 F	1.1 L	445 mL	7	
		Sevin XLR PLUS	2.5-4 L	1-1.6 L	1	
Grasshoppers	Spray when hopper populations exceed 7-12/m² (yd²).	Furadan 480 F	275 mL	110 mL	7	
		Malathion 500 EC	1.6 L	650 mL	7	
		Sevin XLR PLUS	1.2-2.5 L	485 mL-1L	1	
Wireworms	At planting time.	Counter 15 G	75 g/100 m row	70g/100 yd row	n/a	Apply this rate for 75 cm (30 in) row spacing.
	Treat seed.	Lindane	As directed on container label.	As directed on container label.	n/a	
OILSEED CROPS FLAX						
Bertha armyworm	Spray when larval populations exceed 10/m² (yd²).	Lannate L	1.25 L	505 mL	8	
Cutworms		Decis 5.0 EC	200 mL	80 mL	40	
		Lorsban 4 E	875 mL - 1.2 L	355-485 mL	21	
Grasshoppers	When hopper populations exceed 7-12/m² (yd²).	Decis 5.0 EC	100-150 mL	40-60 mL	40	
		Furadan 480 F	275 mL	110 mL	21	
		Malathion 500 EC	1.6 L	640 mL	7	

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
CANOLA, MUSTARD						
Bertha armyworm, Beet webworm, clover cutworm	When larval populations exceed 20-30/m^2 (yd^2) and pod damage is noted.	Decis 5.0 EC	100-150 mL	40-60 mL	14	Not for beet webworm.
		Lannate L	1.25 L	505 mL	8	Use higher rates for larger larvae or when foliage is dense.
		Lorsban 4 E	750 mL-1 L	305-405 mL	21	
		Monitor 480 L	550-1100 mL	225-450 mL	10	
Cutworms	When numbers exceed 3-4/m^2 (yd^2).	Ambush 500 EC	140-300 mL	60-120 mL	1	For dry soil conditions use higher rate.
		Lorsban 4 E	875 mL - 1.2 L	355-485 mL	21	
Diamondback moth	When numbers exceed 30/0.1 m^2 (30/ft^2).	Decis 5.0 EC	100-150 mL	40-60 mL	14	
		Dylox 420 Liquid	2.8 L	1.1 L	11	Use Dylox during late evening when honeybees are not foraging.
		Guthion SC	550 mL - 1.25 L	225-505 mL	30	
		malathion 500 EC	700 mL	285 mL	7	
		Supracide 240	1.1 L	445 mL	30	
Flea beetles *At Seeding*	Mix with seed. Use with drill seeder only.	Counter 5 G	5.5-11.0 kg	2.2-4.5 kg	n/a	Do not handle with bare hands, wear rubber or PVC gloves.
	Mix with seed. Use drill seeder only.	Furadan CR-10	2.8 kg	1.1 kg	n/a	Do not use feed or feed mixing equipment to mix seed treatments or dressings.
	Mix with seed. Use drill seeder only.	Furadan 5G	4.5 kg	1.8 kg	n/a	
	Treat seed.	lindane seed treatment	As directed on container label.	As directed on container label.	n/a	
Foliage Sprays	Apply post-emergence sprays when 25% of the leaf surface of seedling plants is destroyed by beetles.	Cymbush 250 EC	140 mL	60 mL	30	

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
Foliage sprays, cont.		Decis 5.0 EC	100-150 mL	40-60 mL	14	Do not apply at temperatures above 25 degrees C.
		Furadan 480 F	140-280 mL	60-115 mL	60	Do not apply more than 280 mL Furadan per ha per season.
		malathion 500 EC	1.1 L	16 fl oz	7	
		Sevin XLR PLUS	500 mL	200 mL		Do not use Sevin or Furadan after pod formation.
Grasshoppers		Furadan 480 F	280 mL	115 mL	60	
		Lorsban 4E	580-875 mL	235-355 mL	21	
		malathion 500 EC	1.6 L	650 mL	7	
Red turnip beetle	Spray field margins when infestations occur.	Furadan 480 F	280 mL	115 mL	60	
		Guthion SC	550-800 mL	225-325 mL	30	
SUNFLOWERS						
Cutworms	When stand reduction exceeds 25-30%	Ambush 500 EC	140-300 mL	60-120 mL	1	For dry soil conditions use higher rate.
		Lorsban 4 E	875 mL - 1.2 L	355-485 mL	90	
Sunflower beetle	Spray when adult beetle populations exceed 1/2 seedling plants or when larval populations exceed 10-15/plant.	Cymbush 250 EC	100 mL	40 mL	70	Ground application only. Apply in 100-200 L/ha (10-20 gal/ac) water.
		Decis 5.0 EC	100 mL	40 mL	70	Apply in 100-200 L water/ha (10-20 gal/ac) by ground or 11-22 L/ha (1-2 gal/ac) by air.
		Furadan 480 F	140-280 mL	60-115 mL	60	Use higher rate for adult beetles.

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
FORAGE CROPS						
ALFALFA (SEED)						
Plant bugs, Lygus bugs	Apply just before alfalfa begins to bloom. A second application may be required later in the season if plant bug numbers exceed 5/sweep. Use Dylox on crops in bloom.	Decis 5.0 EC	200 mL	80 mL		Do not put leafcutter bees on crop within 7 days of spraying with Dimethoate or Supracide or within 1 day with Decis. Do not apply Decis by air. Apply Dylox in late evening when bees are not foraging.
		dimethoate 40	850 mL - 1.5 L	350-710 mL	28	
		Dylox 420 Liquid	1.4 L	570 mL	14	
		Supracide 240 EC	1.1-2.2 L	450-890 mL	10	
SWEET CLOVER						
Sweet clover weevil	Apply to seedling crops when weevil damage is first noticed.	Guthion SC	2.25 L	910 mL		Second year crops rarely need protection.
		Sevin XLR PLUS	2.5 L	1.0 L		
ALFALFA, CLOVER, GRASSES						
Grasshoppers	Spray when hopper populations exceed 13-25/m² (yd²).	Furadan 480 F	275 mL	110 mL	1	Do not apply to sweet clover within 28 days of harvest or grazing.
		malathion 500 EC	1.6 L	650 mL	7	
		Sevin XLR PLUS	1.2-3.5 L	490 mL -1.4 L	2	
PASTURES						
Grasshoppers	Spray when hopper populations exceed 13-25/m² (yd²).	Furadan 480 F	275 mL	110 mL	1	
		malathion 500 EC	1.6 L	650 mL	0	May be grazed on day of application.
		Sevin XLR PLUS	2.3-3.5 L	1-1.4 L	1	
SPECIAL CROPS						
SUGAR BEETS						
Beet webworm	Spray early to late June when leaf damage occurs.	Dylox 420 Liquid	2.8 L	1.1 L	14	
Cutworms		Ambush 500 EC	140-300 mL	60-120 mL	1	Ground application only. For dry soil conditions use higher rate.

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
Cutworms, cont.	Spray seedling crops when damage occurs.	Lorsban 4 E	1.2-2.4 L	490-970 mL	90	
Sugarbeet root maggot		Counter 15 G	7.3 kg	2.9 kg		Do not apply Counter in direct contact with seed.
	Apply to drill row at seeding.	Furadan 10 G	8.25 kg	3.3 kg		
		Temik 10 G	11 kg	4.5 kg		
FABA BEANS						
Aphids	Spray when 75% of the plants have aphids.	Dimethoate 40	525 mL	215 mL	7	
		malathion 500 EC	2 L	810 mL		
FIELD PEAS						
Aphids	Spray when an average of 2-3 aphids per 20 cm (8 in) plant tip are present at flowering.	Dimethoate 40	525 mL	210 mL	3	
		malathion 500 EC	1.4 L	570 mL	3	
VEGETABLE INSECTS - COMMERCIAL						
ALL VEGETABLES						
	Apply immediately when damage is seen.	Ambush 500 EC	140-300 mL	56-120 mL	Variable	
Cutworms	Apply along rows immediately when damage is seen.	Lorsban 4 E	1.4-2.8 L	570-1.1 L	Variable	
BEETS						
Leafminers	Spray when egg masses are noticed on underside of leaves.	malathion 500 EC	1.75 L	710 mL	7	For bunching beets only.
Tarnished plant bug		Cygon 480 EC	700 mL	280 mL	12	
CABBAGE, CAULIFLOWER, BRUSSEL SPROUTS, BROCCOLI						
Aphids		Cygon, Lagon 480 EC	550-1000 mL	225-400 mL	4 (21 for brussel sprouts)	

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
Aphids, cont.		malathion 500 EC	1.1-2.8 L	450 mL-1.1 L	7 (3 for broccoli)	
		Monitor 480 L	1.2-2.3 L	490-930 mL	7-cabbage, cauliflower 14-broccoli, brussel sprouts	
Cabbage worms, loopers, diamondback moth		Ambush 500 EC	70-140 mL	30-60 mL	3 (7 for broccoli)	
		Belmark 300 EC	150-325 mL	60-130 mL	14	
		Decis 5 EC	150-200 mL	60-80 mL	3	
		diazinon 50 E	1.1 L	450 mL	7	
		Dipel	Follow label		0	
		Lannate L	1.25-2.5 L	500 mL-1.0 L	7 (1 for cabbage)	
		Monitor 480 L	1.2-2.3 L	490-930 mL	7-cauliflower, cabbage, 14-broccoli, brussel sprouts	
		Thiodan 4E, Endosulfan 400	1.4-2.1 L	570-850 mL	7	
Flea beetles		Thiodan 4 E, Endosulfan 400	2 L	810 mL	7	
Root maggots	Apply granules at time of seeding.	Dasanit 15 G	1250 g/1000 m of row	375 g/1000 ft of row		
	Apply as a seedling drench.	Lorsban 4 E	210 mL/1000 m of row	65 mL/1000 ft of row		
Slugs		metaldehyde				Do not apply directly to plants. Use baits or liquid slug killers according to label directions.
CARROTS						
Leafhoppers	For prevention of aster yellows, apply at time of seeding.	Furadan 10 G	22.5 kg	9.1 kg		

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
Leafhoppers, cont.		malathion 500 EC	1-3 L	400 ml - 1.2 L	7	
		Sevin XLR PLUS	1.25-2.5 L	500 mL - 1 L	1	Use lower rate of Sevin on young plants.
CELERY						
Aphids		malathion 500 EC	2.0 L	810 mL	3	
Leafhoppers		Cymbush 250 EC	140 mL	60 mL		
		malathion 500 EC	2.0 L	810 mL		
		Lannate L	2.6 L	1 L	3	
		Sevin XLR PLUS	1.25-2.5 L	500 mL - 1 L		
Slugs	Spray between rows (not on plants) in early June. Repeat as required or apply metaldehyde baits between rows.	metaldehyde				
CORN (Sweet)						
European corn borer	Apply two or more sprays when 15% or more plants show leaf feeding in the whorls (early July).	Ambush 500 EC	200-275 mL	80-110 mL	1	
		Furadan 480 F	1.1 L	450 mL	7	
		Lannate L	2.6 L	1 L	3	
		Sevin XLR PLUS	2.5-4.0 L	1-1.6 L	1	
CUCUMBERS						
Cucumber beetle		Guthion SC	2.25 L	910 mL	6	
		Thiodan 4 E, Endosulfan 400	1.5 L	610 mL	2	
EGGPLANT						
Aphids		malathion 500 EC	1.1-2.8 L	450 mL - 1.1 L	3	
		Thiodan 4 E, Endosulfan 400	1.5 L	610 mL	2	
Colorado potato beetle		Sevin XLR PLUS	1.25 L	500 mL	1	
		Thiodan 4 E, Endosulfan 400	1.5 L	610 mL	2	

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
Flea beetle		Thiodan 4 E, Endosulfan 400	1.5 L	610 mL	2	
ONIONS						
(Onion maggot furrow treatment) (table onions)	Apply granules to rows spaced at 40 cm with positive feed Gandy-type applicator in furrow with the seed.	Dasanit 15 G	7.5 kg	3 kg		
		diazinon 5 G	34 kg	13.8 kg		
		Dyfonate 10 G	11 kg	4.5 kg		For organic soils only (more than 10% organic matter).
Onion maggot flies	Spray when flies appear after seedlings emerge and during July.	diazinon 500 EC	1.1 L	450 mL	10	
POTATOES						
Aphids	Spray when aphid numbers exceed 30/100 leaves.	Belmark 300 EC	230-330 mL	95-135 mL	7	
		Cygon 480 EC	580-1400 mL/ha	235-560 mL	7	
		malathion 500 EC	1.25 L	500 mL	7	
		Monitor 480 L	1.75-2.25 L	710-910 mL	14	
		Thiodan 4 E, Endosulfan 400	1.5 L	610 mL	0	
Colorado Potato beetle	Spray when leaf damage exceeds 10%.	Ambush 500 EC	140-200 ml	60-80 mL	1	
		Belmark 300 EC	100-150 mL	40-60 mL	7	
		Decis 5.0 EC	100-150 mL	40-60 mL	23	Aircraft application allowed only twice a season.
		Furadan 480 F	1.1 L	450 mL	7	
		Guthion SC	1.25-1.75 L	500-710 mL	7	
		Monitor 480 L	1.75-2.25 L	710-910 mL	14	
		Sevin XLR PLUS	1.25 L	500 mL	7	
		Supracide 240 EC	1.2 L	490 mL	14	
	Apply at seeding.	Thimet 15 G	15-21 kg	6-8.5 kg		

Crop and Pest	Where and When to Apply	Insecticide And Most Common Formulation	Amount of Product Per Hectare	Amount of Product Per Acre	Minimum Days to Harvest, Feeding	Remarks
Colorado Potato Beetle, cont.		Thiodan 4 E, Endosulfan 400	1.5 L	610 mL		
Potato leafhopper	Spray when leafhopper numbers exceed 30/100 leaves.	Ambush 500 EC	140-200 mL	57-80 mL	1	
		Belmark 300 EC	100-315 mL	40-128 mL	7	
		Supracide 240 EC	1.2 L	490 mL	14	
RADISH						
Flea beetles		diazinon 500 EC	1.1 L	450 mL	10	
		malathion 500 EC	1.1-2.8 L	45 mL - 1.1 L	7	
Radish maggot	Apply granules in furrow when planting.	Diazinon 5 G	1.8 kg/ 1000 m of row	565 g/1000 ft of row		
RUTABAGA, TURNIP						
Flea beetles		diazinon 500 EC	1.1 L	450 mL	14	
		Thiodan 4 E, Endosulfan 400	2.1 L	810 mL	45	
Root maggots BAND TREATMENT		Dasanit 15 G	1.15 kg/ 1000 m row	360 g/1000 ft row		
		diazinon 5 G	1.8 kg/ 1000 m row	565 g/1000 ft row		
DRENCH TREATMENT		Dasanit 7.2 EC	3.1 L	1.2 L		
		diazinon 500 EC	2.8 L	1.1 L	14	
TOMATO						
Flea beetles		Thiodan 4 E, Endosulfan 400	1.5 L	600 mL	2	
Variegated cutworm		Sevin XLR PLUS	125 mL/ 300 m of row	43 mL/300 ft of row	1	

VEGETABLE INSECTS -HOME GARDEN

Insecticides recommended in this section may be sold under a variety of trade names. The label guarantee will list the insecticides that the package contains.

Pest	Insecticide	Metric	Imperial Measure	Remarks
Aphids	diazinon 12.5% EC	8 ml/L	8 tsp/gal	
	dimethoate 2 E	2 mL/L	2 tsp/gal	
	malathion 50% EC	2 mL/L	2 tsp/gal	
Colorado Potato Beetle, Flea Beetles	carbaryl 50 WP	4 mL/L	4 tsp/gal	
	diazinon 12.5% EC	8 mL/L	8 tsp/gal	
	malathion 50% EC	8 mL/L	8 tsp/gal	
	methoxychlor 25 EC	10 mL/L	10 tsp/gal	
	rotenone D			Dust plants as required.
Imported Cabbage worm, Cabbage looper, Diamondback moth	diazinon 12.5% EC	8 mL/L	8 tsp/gal	
	malathion 50% EC	4 mL/L	4 tsp/gal	
	rotenone D			Dust plants thoroughly.
Cutworms	chlorpyrifos 0.5 G			Use according to label directions.
	chlorpyrifos 10 EC			Use according to label directions.
	diazinon 5 G			Use according to label directions.
European corn borer, Corn earworm	carbaryl 50% SP	6-10 g/L	6-10 tsp/gal	Spray at weekly intervals from early July to mid-August.
	malathion 50% EC	3 mL/L	3 tsp/gal	
Turnip, Cabbage, Radish maggots	diazinon 5% G			Apply granules according to label prior to planting.
	diazinon 12.5% EC	8 mL/L	8 tsp/gal	Apply as a drench to rows.
Slugs	metaldehyde			Use prepared slug baits.

FRUIT INSECTS

Insecticides recommended in this section may be sold under a variety of trade names. The label guarantee will list the insecticides that the package contains.

Crop and Pest	Insecticide And Most Common Formulation	MIXTURE AND METHOD OF TREATMENT Metric	Imperial Measure	Minimum Days From Last Application to Harvest	Remarks
APPLE, PLUM, OTHER FRUIT TREES					
Tent Caterpillar	carbaryl 50% WP	Mix 2-4 g in 1 L water. Spray when larvae are seen or damage is noticed.	Mix 5 tsp in 1 gal water. Spray when larvae are seen or damage is noticed.	3	
	malathion 50% EC	Mix 1-2 mL in 1 L water. Spray when larvae are seen or damage is noticed.	Mix 1-2 tsp in 1 gal water. Spray when larvae are seen or damage is noticed.	3	
	methoxychlor 50% WP	Mix 2 g in 1 L water. Spray when larvae are seen or damage is noticed.	Mix 2 tsp in 1 gal water. Spray when larvae are seen or damage is noticed.	7	
Apple seed chalcid	methoxychlor 50% WP	Mix 2 g in 1 L water and spray about June 18. Repeat 1 week later.	Mix 2-4 tsp in 1 gal water water and spray about June 18. Repeat 1 week later.	7	
Aphids	diazinon 12 1/2% EC	Mix 6 mL in 1 L water and spray as foliar spray. Repeat as necessary.	Mix 2 tbsp in 1 gal water and spray as foliar spray. Repeat as necessary.		
	dimethoate 2E	Mix 2 mL in 1 L water. Apply as foliar spray. Repeat as necessary.	Mix 2 tsp in 1 gal water. Apply as foliar spray. Repeat as necessary.	7	
	malathion 50% EC	Mix 2 mL in 1 L water and apply as a foliar spray. Repeat as needed.	Mix 2 tsp/gal water and apply as a foliar spray. Repeat as needed.	3	
Scale	carbaryl 50% WP	Mix 2-4 g in 1 L water; apply to infested areas.	Mix 2-4 tsp in 1 gal water; apply to infested areas.	7	
	diazinon 12 1/2% EC	Mix 2 mL in 1 L water. Apply as a spray to trunk and branch where scales are found.	Mix 2 tsp in 1 gal water. Apply as a spray to trunk and branch where scales are found.	14	
	malathion 50% EC	Mix 2 mL in 1 L water and apply to infested areas.	Mix 2 tsp in 1 gal water and apply to infested areas.	3	

Crop and Pest	Insecticide And Most Common Formulation	MIXTURE AND METHOD OF TREATMENT Metric	Imperial Measure	Minimum Days From Last Application to Harvest	Remarks
Fall cankerworm	carbaryl 50% WP	Mix 6 g in 1 L water. Spray in early spring when larvae are seen or damage is noticed.	Mix 1 oz/gal water. Spray in early spring when larvae are seen or damage is noticed.	n/a	
	methoxychlor 50% WP	Mix 2 g in 1 L water and spray in early spring when larvae are seen or damage is noticed.	Mix 1/3 oz/gal water and spray in early spring when larvae are seen or damage is noticed.	n/a	
	Tree tanglefoot	Ready-to-use. Apply to tree trunks in late Sept. immediately after first heavy frost.	Ready-to-use. Apply to tree trunks in late Sept. immediately after first heavy frost.		
Plum curculio	methoxychlor 50% WP	Mix 3 g in 1 L water. Apply as a spray when fruit is just beginning to form. Repeat application 10 days later.	Mix 3 tsp in 1 gal water. Apply as a spray when fruit is just beginning to form. Repeat application 10 days later.	7	
Apple maggot	carbaryl 50% WP	Mix 8 g in 1 L water and apply.	Mix 4 tbsp in 1 gal water and apply.	14	Begin spraying in late June or early July and continue every 7-10 days through August.
CURRANT, GOOSE BERRY					
Currant fruit fly	methoxychlor 50% WP	Mix 2 g in 1 L water and apply as spray when 80% of the fruit has set. Repeat application 10 days later.	Mix 2 tsp in 1 gal water and apply as spray when 80% of the fruit has set. Repeat application 10 days later.	14	
Imported currant worm	diazinon 12 1/2% EC	Mix 4 mL in 1 L water and apply as spray.	Mix 4 tsp in 1 gal water and apply as spray.		Apply when insects are seen but not during or after bloom.
	rotenone 1% D	Apply to plants after fruit is set.	Apply to plants after fruit is set.		
Aphids	malathion 50% EC	Mix 1.5 mL in 1 L water and use as spray when aphids appear. Repeat as needed.	Mix 1 1/4 tsp in 1 gal water and use as spray when aphids appear. Repeat as needed.	3	
RASPBERRY					
Raspberry fruitworm	diazinon 12 1/2% EC	Mix 4 mL in 1 L water and apply as spray.	Mix 4 tsp in 1 gal water and apply as spray.	1	Apply when insects appear but not after blossoming.

Crop and Pest	Insecticide And Most Common Formulation	MIXTURE AND METHOD OF TREATMENT		Minimum Days From Last Application To Harvest	Remarks
		Metric	Amount of Product Per Acre		
Raspberry fruitworm cont.	rotenone 40% WP	Mix 5 g in 1 L water. Apply when berries start to form.	Mix 5 tbsp. in 1 gal. water. Apply when berries start to form.	1	
Spider mites	Kelthane EC	Mix 4 mL in 1 L water. Apply when necessary and repeat as required.	Mix 2 tbsp in 1 gal water. Apply when necessary and repeat as required.	7	
STRAWBERRY					
Plant bug	Cygon 2E	Mix 2 mL in 1 L water.	Mix 2 tsp in 1 gal water.	7	
Spider mite	Kelthane EC	Mix 4 mL in 1 L water. Apply when necessary and repeat as required.	Mix 2 tbsp in 1 gal water. Apply when necessary and repeat as required.	7	
COMMERCIAL APPLICATION STRAWBERRY					
Aphid	Cygon, Lagon 480 EC	2.75 L/ha	1.1 L	7	
	diazinon 50 E	1-2 L/ha	400-800 mL	5	
	malathion 500 EC	2 L/ha	800 mL	3	Do not use malathion at temperatures below 18°C (70°F).
Cyclamen mite	Kelthane EC	5.5-15 L/ha	2.2-6 L	7	Begin applications in early spring where mites appear and repeat 2 or 3 times at 10-30 day intervals.
	Thiodan, Thionex 50 WP	4.5-9 kg/ha	1.8-3.6 kg	7	Apply before bud formation in spring. Repeat after harvest.
Leafroller	diazinon 50 E	2 L/ha	800 mL	5	
	Guthion SC	2.25 L/ha	900 mL	5	Apply when larvae first appear. Do not use malathion at temperatures below 18°C (70°F).
	malathion 500 EC	2 L/ha	800 mL	3	

Crop and Pest	Insecticide And Most Common Formulation	MIXTURE AND METHOD OF TREATMENT Metric	Amount of Product Per Acre	Minimum Days From Last Application To Harvest	Remarks
Plant bug	Cygon, Lagon 480 EC	2.75 L/ha	1.1 L	7	Apply when one or more nymphs per blossom cluster are found. Do not apply Cymbush more than 3 times per season. Do not apply Furadan later than first blossom.
	Cymbush 250 EC	400 mL/ha	160 mL	7	
	Furadan 480 F	1.1 L/ha	440 mL	n/a	
	Thiodan, Thionex 50 WP	2.2 kg/ha	880 g	7	
Spider mite	Cygon, Lagon 480 EC	2.75 L/ha	1.1 L	7	Begin applications in early spring when mites appear and repeat according to label instructions. Do not apply malathion at temperatures below 18°C (70°F).
	Kelthane EC	5.5-15 L/ha	2.2-6 L	7	
	malathion 500 EC	2 L/ha	800 mL	3	
Strawberry cutworm	Lorsban 4 E	1.2 L/ha	480 mL	20	Apply between June 1-15 when wilting of leaves is seen.
Strawberry root weevil	Furadan 480 F	1.1-2.5 L/ha	440 mL - 1 L	n/a	Apply when fresh leaf notches are seen. Do not apply Furadan between blossoming and harvest. Do not apply malathion at temperatures below 18°C (70°F).
	malathion 500 EC	2.8-4.2 L/ha	1.1-1.7 L	3	
Strawberry weevil	Cymbush 250 EC	280 mL/ha	112 mL	7	Apply when insects are present or damage is noticed. Do not use Cymbush more than 3 times per season. Do not apply Furadan later than first bloom.
	Furadan 480 F	1.1 L/ha	0.4 L	n/a	

COMMERCIAL GREENHOUSE INSECTS

It is important to rotate classes of insecticides to delay development of resistance.
NOTE: WEAR SPECIAL PROTECTIVE EQUIPMENT WHEN USING FUMIGANTS OR SMOKES AND VENTILATE THOROUGHLY AFTER EXPOSURE PERIOD.

Host and Pest	Insecticide	Metric	Imperial Measure	Remarks
ORNAMENTAL PLANTS				
Aphids	D.D.V.P.	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	diazinon 500 EC	100-150 ml/100 L water	1.6-2.4 fl oz/10 gal water	
	lindane	1 pellet/255 m^3	1 pellet/9,000 cu ft	
	malathion 500 EC	200 mL/100 L water	3.2 fl oz/10 gal water	
	Metasystox-R	175-375 mL/100 L water	2.8-5.9 fl oz/10 gal water	
	nicotine sulfate	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Pirimor 50 WP	50 g/100 L water	0.7 oz/10 gal water	
	Insecticidal soap	1 part soap/50 parts water	1 part soap/50 parts water	
	sulfotep	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Temik 10 G	600-1250 g/100 m^2	20-40 oz/1,000 sq ft	Extremely toxic. Follow label safety instructions closely. Chrysanthemums only. Do not market potted plants within 4 weeks of last application. Do not work treated area within 48 hours of application.
	Thiodan 4 EC	125 mL/100 L water	1.9 fl oz/10 gal water	
Greenhouse whitefly, Sweet Potato Whitefly	Ambush 500 EC	12-20 mL/100 L water	0.2-0.3 fl oz/10 gal water	
	D.D.V.P.	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	lindane	1 pellet/255 m^3	1 pellet/9,000 cu ft	
	Lorsban 25 WP	96 g/100 gal water	1.8 oz/10 gal water	
	malathion 500 EC	250 mL/100 L water	3.2 fl oz/10 gal water	
	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic

Host and Pest	Insecticide	Metric	Imperial Measure	Remarks
Greenhouse Whitefly, Sweet Potato Whitefly, cont.	Insecticidal soap	1 part soap/100 parts water	1 part soap/100 parts water	
	sulfotep	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Temik 10 G	600-1250 g/100 m^2	20-40 oz/1000 sq ft	Extremely toxic. Follow label instructions carefully. Chrysanthemums and Poinsettia only. Do not market potted plants within 4 weeks of last application. Do not work treated area within 48 hours of application.
	Thiodan 4 EC	125 mL/100 L water	1.9 fl oz/10 gal water	
Mealybugs	D.D.V.P.	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Lorsban 25 WP	390 g/100 L water	1.8 fl oz/10 gal water	
	malathion 500 EC	250 mL/200 L water	3.2 fl oz/10 gal water	
	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Insecticidal soap	1 part soap/100 parts water	1 part soap/100 parts water	
	sulfotep	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
Thrips	D.D.V.P.	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Decis 5 EC	35-50 mL/100 L water	0.4-0.7 fl oz/10 gal water	Do not apply within 7 days of harvest. Do not use with fogging machines.
	diazinon 500 EC	100-150 mL/100 L water	1.6-2.4 fl oz/10 gal water	
	lindane	1 pellet/200 m^3	1 pellet/7,000 cu ft	
	Lorsban 25 WP	96 g/100 L water	1.8 fl oz/10 gal water	
	malathion 500 EC	130-250 mL/100 L water	2.1-3.9 fl oz/10 gal water	
	nicotine sulfate	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Trumpet 80 WP	125 g/100 L water	2 fl oz/10 gal water	
Spider Mite	D.D.V.P.	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Kelthane 18.5 E	120 mL/100 L water	2 fl oz/10 gal water	

Host and Pest	Insecticide	Metric	Imperial Measure	Remarks
Spider Mite, cont.	malathion 500 EC	130-250 mL/100 L water	2.1-3.9 fl oz/10 gal	
	Metasystox-R	175-373 mL/100 L water	2.8-5.9 fl oz/10 gal	
	parathion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Pentac 50 WP	62 g/100 L water as a spray	1 fl oz/10 gal water as a spray	
	Insecticidal soap	1 part soap/50 parts water	1 part soap/50 parts water	
	sulfotep	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	Extremely toxic
	Tedion	1 can/300 m^3 as a smoke	1 can/10,000 cu ft as a smoke	
	Temik 10 G	600-1250 g/100 m^2	20-40 oz/1000 sq ft	Extremely toxic. Follow label instructions closely. Chrysanthemum and Poinsettia only. Do not market potted plants within 4 weeks of last application. Do not work treated area within 48 hours of application.
	Vendex 50 W	50-100 g/100 L water as a spray	0.8-1.6 fl oz/10 gal water as a spray	

SHADE TREES AND ORNAMENTAL INSECTS

Insecticides recommended in this section may be sold under a variety of trade names. The label guarantee will list the insecticide that the package contains.

Crop and Pest	Insecticide	Metric	Imperial Measure	Application	Remarks
HOME GROUNDS					
BIRCH					
Bronze birch borer	Cultural control is to maintain birch trees in healthy condition through watering and general tree maintenance.				
SPRUCE TREES					
Spruce budworm	Cygon 2 E	4 mL/L of water	2/3 fl oz/gal of water	Spray foliage thoroughly in early June before buds are damaged.	More than one application may be required.
	Dipel			Use according to label instructions.	
	malathion 500 EC	2 mL/L of water	1/3 fl oz/gal of water		
	trichlorfon 420 Liquid			Use according to label instructions.	
Pine needle scale (attacks pine and spruce)	Cygon 2 E	4 mL/L of water	2/3 fl oz/gal of water	Spray till foliage drips. One treatment in mid June and one in August.	
	diazinon 12 1/2 EC	2 mL/L of water	1/3 fl oz/gal of water		
	malathion 500 EC	2 mL/L of water	1/3 fl oz/gal of water		
Spruce spider mite	Kelthane 18.5 EC	2 mL/L of water	1/3 fl oz/gal of water	Spray foliage until wet.	One treatment during the third week in May followed by another in late June or early July.
	malathion 500 EC	4 mL/L of water	2/3 fl oz/gal of water		
TREES AND SHRUBS					
Aphids	Cygon 2E	2 mL/L of water	1/3 fl oz/gal of water	Spray foliage thoroughly as required.	Do not use Cygon on American Elm.
	diazinon 12 1/2 EC	6 mL/L of water	1 fl oz/gal of water		
	malathion 500 EC	2 mL/L of water	1/3 fl oz/gal of water		
Ash plant bug	diazinon 12 1/2 EC	2 mL/L of water	1/3 fl oz/gal of water	Apply when plant bugs are seen or stipling effect is observed on leaves.	
	Sevin 50 WP	2 g/L of water	1/3 oz/gal of water		

Crop and Pest	Insecticide	Metric	Imperial Measure	Application	Remarks
Cankerworm	Dipel			Apply according to label instructions.	
	malathion 500 EC	2 mL/L of water	1/3 fl oz/gal of water	Spray foliage when damage appears in spring.	
	methoxychlor 50 WP	2 g/L of water	1/3 fl oz/gal of water		
	Sevin 50 WP	6 g/L of water	1 oz/gal of water		
	tree tanglefoot	Ready-to-use	Ready-to-use	Apply to tree trunks in late September immediately after first heavy frost.	
Pear slug	malathion 500 EC	2 mL/L of water	1/3 fl oz/gal of water	Spraying is usually required in late June and early July.	
	rotenone	Ready-to-use	Ready-to-use		
	Sevin 50 WP	2 g/L of water	1/3 oz/gal of water		
Leafminers	Cygon 2E	2 mL/L of water	1/3 fl oz/gal of water	Two applications are necessary for full season control, one in spring and one about the end of July.	
	diazinon 12 1/2 EC	2 mL/L of water	1/3 fl oz/gal of water		
	malathion 500 EC	2 mL/L of water	1/3 fl oz/gal of water		
	Sevin 50 WP	2 g/L of water	1/3 oz/gal of water		
Sawflies	malathion 500 EC	2 mL/L of water	1/3 fl oz/gal of water	Spray foliage when insects and damage become evident.	
Gall insects					Effective control is not available. Damage usually does not effect tree health. Remove and burn galls if possible.
ELM					
Elm bark beetle	Dursban	0.5% solution	0.5% solution	Apply between August 14 and September 5. Thoroughly wet lower 2.5 m (8 ft) of tree to base of root flare.	
	methoxychlor	4-12% solution	4-12% solution		
Spiny elm caterpillar	malathion 500 EC	2 mL/L of water	1/3 fl oz/gal of water		Caterpillars are generally localized in one part of the tree. Spray where needed.

Crop and Pest	Insecticide	Metric	Imperial Measure	Application	Remarks
COMMERCIAL APPLICATION					Do not apply with aircraft at wind speeds in excess of 12 km/hr.
CONIFERS					
Spruce budworm	Ambush 500 EC	35-70 mL/ha	0.5-1 fl oz/ac		
	Cygon, Lagon 480 EC	1.1 L in at least 10 L of water/ha	24 fl oz in at least 1 gal of water/ac	Aerial Application	Apply spray when the bulk of the larvae are in 3rd and 4th instars.
		1.5 L/1000 L of water	20 fl oz/100 gal of water	Hydraulic Ground Applicator	More than one application may be required to achieve adequate control.
	Dipel			According to label.	
	Dylox 420 Liquid	2.8-3.5 L in at least 22 L water/ha	2-2 7/8 pts in at least 2 gal water/ac	Aerial Application	May cause spotting of automobile paint surfaces.
		2.8-3.5 L in 1400 L of water/ha	2-2 7/8 pts in at least 125 gal water/ac	Hydraulic Ground Applicator	
	malathion 500 EC	1.5 L in at least 10 L water/ha	20 fl oz in at least 1 gal of water/ac	Aerial Application	
		1 L in 1000 L of water	16 fl oz in 100 gal of water	Hydraulic Ground Applicator	
	Thuricide			According to label.	
DECIDUOUS TREES					
Cankerworm	Dipel			According to label.	
	malathion 500 EC	1.5 L in at least 10 L of water/ha	20 fl oz in at least a gal of water/ac	Aerial Application	
		1.5 L in 1000 L of water	20 fl oz in 100 gal of water	Hydraulic Ground Applicator	
	methoxychlor 50 WP	2 kg in 1000 L of water	16 fl oz in 100 gal of water	Hydraulic Ground Applicator	
	Thuricide			According to label.	

Crop and Pest	Insecticide	Metric	Imperial Measure	Application	Remarks
Scale Insects	Ambush 500 EC	35-70 mL/ha	0.5-1 fl oz/ac		
	Cygon, Lagon 480 EC	110 mL/450 L of water	4 fl oz/100 gal of water	Hydraulic Ground Applicator	
	diazinon 12 1/2% EC	225 mL/450 L of water	8 fl oz/100 gal of water	Hydraulic Ground Applicator	
	malathion 500 EC	225 mL/450 L of water	8 fl oz/100 gal of water	Hydraulic Ground Applicator	
	Sevin 50 WP	55-70 g/45 L of water	2-2.5 oz/10 gal of water	Hydraulic Ground Applicator	Apply insecticides during crawler stage approximately mid-June.

TURF INSECTS

Insecticides recommended in this section may be sold under a variety of trade names. The label guarantee will list the insecticide that the package contains.

Crop and Pest	Insecticide And Most Common Formulation	Metric	Imperial Measure	Application	Remarks
Ants	chlorpyrifos 2E	45 mL/100 m^2	1.5 fl oz/1000 ft^2	Water into soil after application.	
	diazinon 12 1/2% EC	300-600 mL/100 m^2	10-20 fl oz/1000 ft^2	Apply in 10-20 gal (50-90 L) of water.	Mow lawn before treatment. Water thoroughly after treatment.
Chinch bug	chlorpyrifos 2E	45 mL/100 m^2	1.5 fl oz/1000 ft^2		Control when nymph/adult numbers exceed 20 per 0.1 m^2 (ft^2).
Earthworms Dew worms	carbaryl 50% WP	250 g/100 m^2	16 oz/1000 ft^2	Apply in 90 L (20 gal) of water.	
Glassy cutworm	Chlorpyrifos 2E	45 mL/100 m^2	1.5 fl oz/1000 ft^2		
	diazinon 12 1/2% EC	250 mL/5 L water/100 m^2	8 fl oz/gal water/1000 ft^2		
Sod webworm	chlorpyrifos 2E	45 mL/100 m^2	1.5 fl oz/1000 ft^2		
	diazinon 12 1/2% EC	300-600 mL/5 L water/100 m^2	10-20 fl oz/gal water/1000 ft^2		Water thoroughly after treatment.
White grub	chlorpyrifos 2E	90 mL/100 m^2	3 fl oz/100 ft^2		Water thoroughly after treatment. Apply between July and early October.
	diazinon 12 1/2% EC	600 mL/5 L water/100 m^2	20 fl oz/gal water/1000 ft^2		

HOUSEHOLD INSECTS

Insecticides recommended in this section may be sold under a variety of trade names. The label guarantee will list the insecticide that the package contains.

Pest	Insecticide And Most Common Formulation	Metric	Imperial Measure	Where To Apply	Remarks
Ants	chlorpyrifos	Ready-to-use solution.	Ready-to-use solution.	Spray around doorsteps and lower windows to prevent entry to home. Indoors, spray around sinks, baseboards and other areas where ants are found.	Do not treat countertops or other surfaces coming in direct contact with food.
	diazinon 12 1/2% EC	50 mL in L water	1 fl oz in 1 pint water.		
	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.		
	resmethrin	Ready-to-use aerosol.	Ready-to-use aerosol.		
Bedbug	malathion (premium grade) 83.6% EC	8 mL in L water on mattresses and upholstery; 20 mL elsewhere	1 tsp in 1 pint water on mattresses and upholstery	Spray bed springs and frames, cracks and crevices in wall where bedbugs hide. Mattresses, particularly tufts and folds should be lightly sprayed.	Use only premium grade deodorized malathion.
Black carpet beetle	chlorpyrifos	Ready-to-use solution.	Ready-to-use solution.	Spray cracks and crevices around baseboards or where larvae are noticed.	Vacuuming of baseboards and other places eliminates carpet beetles. Protect stored woolens and other material fabrics with moth flakes.
	diazinon 12 1/2% EC	50 mL in L water	1 fl oz in pint water.		
	malathion (premium grade) 83.6% EC	50 mL in L water	1 fl oz in 1 pint water		
	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.		
Boxelder bug	Methoxychlor	Ready-to-use aerosol.	Ready-to-use aerosol.	Spray around entrance areas where boxelder bugs congregate.	House cleaning indoors will remove boxelder bugs that have gained entrance.
Clothes moth	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.	Spray infested storage areas.	Protect woolens and other natural fabrics with moth flakes.
Clover mite	diazinon 12 1/2% EC	8 mL/L water	1 fl oz/gal water	Spray diazinon, dicofol on grass around foundation of mites from grass into home.	Apply at rate of 5 L spray mixture/10 m of lawn area (1 gal/100 ft^2).
	dicofol 18.5% EC	8 mL/L water	1 fl oz/gal water		
	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.	Spray indoors around windows and doors to prevent entry of mites.	

Pest	Insecticide And Most Common Formulation	Metric	Imperial Measure	Where to Apply	Remarks
Cockroach	chlorpyrifos	Ready-to-use solution.	Ready-to-use solution.	Apply to areas where cockroaches are commonly seen.	Avoid contamination of food or utensils.
	diazinon	50 mL/L water	1 fl oz/pint water		
	permethrin	Ready-to-use aerosol.	Ready-to-use aerosol.		
	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.		
	resmethrin	Ready-to-use aerosol.	Ready-to-use aerosol.		
Cricket	chlorpyrifos	Ready-to-use aerosol.	Ready-to-use aerosol.	Apply indoors around entrances.	
	diazinon 12 1/2% EC	50 mL/L water	1 fl oz/pint water	Spray outdoors around house particularly near entrance.	
	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.	Apply indoors around entrances.	
Fleas (cat and dog)	chlorpyrifos	Ready-to-use solution.	Ready-to-use solution.	Apply to infested areas.	Do not apply to pets or man.
	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.		Keep infested dogs and cats out of the house. Dust pets thoroughly with commercial flea powders.
	resmethrin	Ready-to-use aerosol.	Ready-to-use aerosol.		
Houseflies	dichlorvos	Slow release strip or block	Slow release strip or block	Apply as required as a space spray.	Ensure that doors and windows are screened. Keep garbage in tightly sealed containers to prevent fly breeding.
	permethrin	Ready-to-use aerosol	Ready-to-use aerosol		
	pyrethrum	Ready-to-use aerosol	Ready-to-use aerosol		
	resmethrin	Ready-to-use aerosol	Ready-to-use aerosol		
Centipedes, sowbugs, spiders, silverfish	chlorpyrifos	Ready-to-use solution.	Ready-to-use solution.		
	diazinon 12 1/2% EC	50 mL/L water	1 fl oz/pint water	Apply to cracks, crevices and other hiding places and surfaces where pests are found.	

Pest	Insecticide And Most Common Formulation	Metric	Imperial Measure	Where to Apply	Remarks
Centipedes, sowbugs, spiders, silverfish cont.	malathion (premium grade) 83.6% EC	50 mL/L water	1 fl oz/pint water		
	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.		
	resmethrin	Ready-to-use aerosol	Ready-to-use aerosol		
Larder beetles	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.	Apply to storage areas where larvae are found.	Destroy infested food. Clean storage areas before spraying.
Stored food insects, flour beetles	malathion (premium grade) 83.6% EC	50 mL/L water	1 fl oz/pint water	Spray storage shelves thoroughly. Package foods can be returned to shelves when spray has dried.	Destroy infested food and clean storage areas before spraying.
	propoxur	Ready-to-use aerosol.	Ready-to-use aerosol.		
Strawberry root weevil	malathion 50% EC	50 mL/L water	1 fl oz/pint water	Apply around entrances of buildings to prevent entry.	
Wasps, hornet, bumble bees	malathion 50% EC	50 mL/L water	1 fl oz/pint water	Direct sprays into entrance holes of nests.	Spray in early morning or late evening when insects are in their nests. Wear mosquito netting, gloves, etc. to prevent stings.
	propoxur	Pressurized pencil spray	Pressurized pencil spray		

STORED GRAIN INSECTS

Pest and Location	Insecticide	Metric	Imperial Measure	Rate of Application	Remarks
EMPTY BINS Rusty grain beetle, Red flour beetle, Saw-toothed grain beetle, Granary weevil	malathion 500	300 mL/5 L water	10 fl oz 50% EC/1 gal water	5 L/100 m^2 (1 gal/1000 ft^2)	Apply to inside surfaces of bins. Also clean and spray area below perforated floors in bins with air drying systems. Wait one day before filling.
FUMIGATION OF GRAIN IN STORAGE	Phoxtoxin, Gastoxin	Ready-to-use tablets or pellets.	Ready-to-use tablets or pellets.	Inject tablets or pellets evenly throughout grain according to label instructions.	Wax coating on tablets prevents release of gas for 4 hours after opening container. Phostoxin is a very toxic gas; seal granary and post warning signs. Work in pairs. Use only when grain temperature is above 5 °C (40 °F).
*Fumigation Period		Grain Temperature 4 °C-12 °C 12 °C-15 °C 16 °C-20 °C	Fumigation Period 10 days 5 days 4 days		Following fumigation, aerate bins for 48 hours or until odor dissipates. Grain can be used for livestock feed following aeration.
CONTROL BY COLD TEMPERATURES	Rusty grain beetles and other stored grain insects can be killed by periods of cold temperatures as follows:				
		Grain Temperature -5 °C -10 °C -15 °C	Time Required to Kill Insects 6 weeks 4 weeks 2 weeks		
	Grain temperatures can be lowered by aeration. Moving grain several times during cold weather may lower temperatures enough to kill insects.				

BEFORE USING ANY
INSECTICIDE
STOP
READ THE LABEL